PB81-238024

Fate of Priority Pollutants in Publicly Owned Treatment Work: Documentation for TOXET Data Set

Burns and Roe Industrial Services Corp.
Paramus, NJ

Prepared for

Environmental Protection Agency
Washington, DC

Oct 79

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. EPA 440/1-79-301

2.

3. PB81-238024

4. Title and Subtitle

Fate of Priority Pollutants in Publicly owned Treatment Work - Documentation for TOXET Data Set

5. Report Date October, 1979

6.

7. Author(s) Howard Feiler

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Burns and Roe Industrial Services Corporation
283 Route 17 South
Paramus, New Jersey 07650

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.

(C)

(G)

12. Sponsoring Organization Name and Address

US EPA
401 M Street, SW
Washington, D.C. 20460

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The US Environmental Protection Agency (EPA) has initiated a program to study the occurrence and fate of 129 selected toxic organic and inorganic pollutants (priority pollutants) by means of a sampling program, at 40 publicly owned treatment works (POTW's). The first phase of this work was a pilot study at two POTW's to select the parameters of interest and establish detailed technical procedures that will be used for the overall project. In this report, data obtained from the two POTW's selected for the pilot study are presented. Since these two plants have different proportions of industrial contributions and priority pollutant levels in POTW influents is examined. Additionally, other specific phinomena were studied, including the overall removal of toxic pollutants, removal of toxic pollutants, removal mechanisms, concentration of toxic pollutants in sludge and the formation of chlorinated hydrocarbons during chlorine hydrocarbon during chlorine disinfection. EPA protocol for collection, sampling and analysis of priority pollutants was followed for each procedure performed in the study, except where noted. Detailed of specific goals of the pilot study are outlined below.

17. Document Analysis a. Descriptors

Publicly owned treatment works, TOXIC pollutants, inorganic, organic, data systems.

b. Identifiers/Open-Ended Terms

PRODUCT OF:
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

c. COSATI Field/Group

18. Availability Statement: Release Unlimited

19. Security Class (This Report) unclassified

20. Security Class (This Page)

21. No. of Pages

22. Price

(See ANSI-Z39.18)

See *Instructions on Reverse*

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

ATTENTION

AS NOTED IN THE NTIS ANNOUNCEMENT, PORTIONS OF THIS REPORT ARE NOT LEGIBLE. HOWEVER, IT IS THE BEST REPRODUCTION AVAILABLE FROM THE COPY SENT TO NTIS.

SECTION I

INDEX

DATA SET: Publicly owned Treatment Works - Burns and Rowe

TABLE OF CONTENTS

DESIGN SECTION I

Fate of Priority Pollutants
in Publicly Owned Treatment
Works: Pilot Study

Page

I. Summary and Conclusions 1

Summary 1

Conclusions 1

II. Introduction 3

Establishment of Sampling Techniques 3

Establishment of Appropriate Sampling Points 3

Development of Analytical Protocol for Samples 4

Fate of Priority Pollutants in POTW's 4

3<

III. Plant Selection 5

Plant A 5

Plant B 5

IV. Sample Point Description 7

Plant A 8

Plant B 10

V. Sampling 13

Sampling Frequency 13

Sampling Techniques 13

Sampling Collection Procedures 13

Protocol and Protocol Modificatios 13

Data Summary 16

Major Trends 16

VII. Analysis of Results 19

Fate of Priority 19

Result of Sampling Frequency and Sampling Point Selection Experiments 30

Potential of Additional Sample Points 33

LIST OF TABLES

Number	Title	Page
IV-1	Sampling Frequency at Plant A	7
IV-2	Sampling Frequency at Plant B	8
VI-1	Summary. Percent Occurrences of Organics Pollutants - Plant A	17
VI-2	Summary Percent Occurrences of Organics Pollutants - Plant B	18
VII-1	Percent Occurrences of Priority Pollutants Plant A	20
VII-2	Percent Occurrences of Priority Pollutants Plant B	22
VII-3	Plant A. Data Summary Week 1 Average	23
VII-4	Plant B. Data Summary	24
VII-5	Plant A. Mass Balance Weekly Summary	26
VII-6	Plant B. Mass Balance Weekly Summary	28
VII-7	Plant A. Effect of Chlorine on Priority Pollutant Concentrations	30
VII-8	Plant B. Effect of Chlorine on Priority Pollutant Concentrations	31
VII-9	8-Hour Composites vs. Metals Concentrations	32

LIST OF FIGURES

Number	Title	Page
IV-1	Influent Sampling Point at Plant A	9
IV-2	Prechlorinated Effluent Sampling Point Plant B	11
IV-3	Final Effluent Sampling Point Plant B	12
V-1	Automatic Sampler	14

QUALITY ASSURANCE FOR LABORATORY ANALYSIS OF PRIORITY POLLUTANTS

i Preface

ii List of Tables

iii List of Figures

iiii Acknowledgements

I INTRODUCTION

II GENERAL QUALITY CONTROL CONSIDERATIONS AND ANALYTICAL METHODOLOGIES

III PRIORITY POLLUTANT LABORATORY QUALITY CONTROL

IV PERFORMANCE CONTROL LIMITS FOR PRIORITY POLLUTANTS

7<

TABLE OF CONTENTS

Page

PREFACE iii
ACKNOWLEDGMENTS v

Chapter

1 IMPORTANCE OF QUALITY CONTROL 1-1
1.1 General 1-1
1.2 Quality Assurance Programs 1-1
1.3 Analytical Methods 1-2
1.4 Reference 1-4

2 LABORATORY SERVICES 2-1
2.1 General 2-1
2.2 Distilled Water 2-1
2.3 Compressed Air 2-5
2.4 Vacuum 2-5
2.5 Hood System 2-5
2.6 Electrical Services 2-6
2.7 References 2-6

3 INSTRUMENT SELECTION 3-1
3.1 Introduction 3-1
3.2 Analytical Balances 3-1
3.3 pH/Selective-Ion Meters 3-3
3.4 Conductivity Meters 3-6
3.5 Turbidimeters (Nephelometers) 3-7
3.6 Spectrometers 3-8
3.7 Organic Carbon Analyzers 3-13
3.8 Gas Chromatographs 3-14
3.9 References 3-14

4 GLASSWARE 4-1
4.1 General 4-1
4.2 Types of Glassware 4-2
4.3 Volumetric Analyses 4-3
4.4 Federal Specifications for Volumetric Glassware 4-4
4.5 Cleaning of Glass and Porcelain 4-5
4.6 Special Cleaning Requirements 4-6
4.7 Disposable Glassware 4-7
4.8 Specialized Glassware 4-7
4.9 Fritted Ware 4-8
4.10 References 4-9

5 REAGENTS, SOLVENTS, AND GASES 5-1
5.1 Introduction 5-1
5.2 Reagent Quality 5-1

5.3 Elimination of Determinate Errors 5-4
5.4 References 5-4

6 QUALITY CONTROL FOR ANALYTICAL PERFORMANCE 6-1
6.1 Introduction 6-1
6.2 The Industrial Approach to QC 6-1
6.3 Applying Control Charts in Environmental Laboratories 6-2
6.4 Recommended Laboratory Quality Assurance Program 6-9
6.5 Outline of a Comprehensive Quality Assurance Program 6-10
6.6 Related Topics 6-13
6.7 References 6-13

7 DATA HANDLING AND REPORTING 7-1
7.1 Introduction 7-1
7.2 The Analytical Value 7-1
7.3 Glossary of Statistical Terms 7-3
7.4 Report Forms 7-5
7.5 References 7-11

8 SPECIAL REQUIREMENTS FOR TRACE ORGANIC ANALYSIS . . . 8-1
8.1 Introduction 8-1
8.2 Sampling and Sample Handling 8-1
8.3 Extract Handling 8-4
8.4 Supplies and Reagents 8-5
8.5 Quality Assurance 8-7
8.6 References 8-10

9 SKILLS AND TRAINING 9-1
9.1 General 9-1
9.2 Skills 9-2
9.3 Training 9-4

10 WATER AND WASTEWATER SAMPLING 10-1
10.1 Introduction 10-1
10.2 Areas of Sampling 10-2
10.3 References 10-6

11 RADIOCHEMISTRY 11-1
11.1 Introduction 11-1
11.2 Sample Collection 11-1
11.3 Laboratory Practices 11-2
11.4 Quality Control 11-4
11.5 References 11-5

12 MICROBIOLOGY 12-1
12.1 Background 12-1
12.2 Specific Needs in Microbiology 12-1
12.3 Intralaboratory Quality Control 12-2
12.4 Interlaboratory Quality Control 12-2
12.5 Development of a Formal Quality Assurance Program 12-3
12.6 Documentation of a Quality Assurance Program 12-3

12.7 Chain-of-Custody Procedures for Microbiological Samples 12-3
12.8 References 12-10

13 AQUATIC BIOLOGY 13-1
13.1 Summary of General Guidelines 13-1
13.2 Discussion 13-2
13.3 Reference 13-4

14 LABORATORY SAFETY 14-1
14.1 Law and Authority for Safety and Health 14-1
14.2 EPA Policy on Laboratory Safety 14-5
14.3 Laboratory Safety Practices 14-7
14.4 Report of Unsafe or Unhealthful Condition 14-15
14.5 References 14-15

Appendix A—Suggested Checklist for the Safety Evaluation of EPA Laboratory Areas A-1

QUALITY ASSURANCE PLANS

Section II

I. Sludge Analytical Protocol

Page

1.1 Scope and Application 1

1.2 Summary 1

1.3 Apparatus and Reagents 2

1.4 Sampling and Preservation 4

1.5 Preparation of Purgeable Organic Free Water 5

1.6 Preparation of Standards 6

1.7 Sample Preparation and Purging 10

1.8 Analysis of the Sample Purge 12

1.9 Purgeable Organics Analytical Quality Assurance 12

1.10 Data Handling 15

II. Method for Semi-volatile Organics 26

2.1 Scope and Application 26

2.2 Summary 26

2.3 Apparatus 27

2.4 Reagents 28

2.5 Preparation of Standards 30

2.6 Sampling and Preservation 30

2.7 Sample Extraction 31

2.8 Extract Clean-up 33

2.9 Sample Extract Analysis 35

2.10 Extractable Organics Analytical Quality Assurance 37

2.11 Data Handling 41

Appendix 51

III. Quality Assurance for Laboratory Analysis of 129 Priority Pollutants

IV. Priority Pollutant Methodology Quality Assurance Review

Page

1. Abstract
2. Introduction 2
3. Analytical Methodology 3
4. Quality Assurance Requirements 5
5. Interlaboratory Comparison 9
6. Purgeable Organic Compounds 10
7. Phenolic Acids 12
8. Base/Neutrals Compunds 14
9. Pesticides 17
10. Metals 17
11. Cyanide and Total Phenols 17
12. Summary and Conclusion 18

V. Evaluation of Region VII Data Set

Water

EPA-440/1-79-300

Fate of Priority Pollutants in Publicly Owned Treatment Works

Pilot Study

by
Howard Feiler
Burns and Roe Industrial Services Corporation
283 Route 17 South
Paramus, New Jersey 07652

Project Officer
R. Dean Jarman

Effluent Guidelines Division
Water Planning and Standards
Office of Water and Waste Management
U.S. Environmental Protection Agency
Washington DC 20460

ACKNOWLEDGEMENTS

Acknowledgement is made to Burns and Roe Industrial Services Corporation, Paramus, New Jersey, the EPA contractor for the project. The following members of the technical staff made significant contributions to the overall project effort and execution of the sampling program: Howard D. Feiler, Paul Storch, Henry Celestino, Gary Martin, and Mark Sadowski.

The Environmental Protection Agency personnel contributing to this effort were Project Officer, Dean Jarman, Office of Research and Development, Center for Environmental Research Information; Assistant Project Officer, Arthur Shattuck, Effluent Guidelines Division; Jeffrey Denit, Effluent Guidelines Division, and Thomas O'Farrell, Office of the Deputy Assistant Administrator for Water Planning and Standards.

14<

TABLE OF CONTENTS

I. Summary and Conclusions 1
  Summary 1
  Conclusions 1

II. Introduction 3
  Establishment of Sampling Techniques 3
  Establishment of Appropriate Sampling Points 3
  Development of Analytical Protocol for Samples 4
  Fate of Priority Pollutants in POTW's 4

III. Plant Selection 5
  Plant A 5
  Plant B 5

IV. Sample Point Description 7
  Plant A 8
  Plant B 10

V. Sampling 13
  Sampling Frequency 13
  Sampling Techniques 13
  Sampling Collection Procedures 13
  Protocol and Protocol Modifications 13

VI. Data Summary 16
  Major Trends 16

VII. Analysis of Results 19
  Fate of Priority Pollutants 19
  Results of Sampling Frequency and Sampling Point Selection Experiments 30
  Potential of Additional Sample Points 33

15<

LIST OF TABLES

Number	Title
IV-1	Sampling Frequency at Plant A 7
IV-2	Sampling Frequency at Plant B 8
VI-1	Summary. Percent Occurrences of Organic Pollutants—Plant A 17
VI-2	Summary Percent Occurrences of Organic Pollutants—Plant B 18
VII-1	Percent Occurrences of Priority Pollutants—Plant A 20
VII-2	Percent Occurrences of Priority Pollutants—Plant B 22
VII-3	Plant A. Data Summary Week 1 Average 23
VII-4	Plant B. Data Summary 24
VII-5	Plant A. Mass Balance Weekly Summary 26
VII-6	Plant B. Mass Balance Weekly Summary 28
VII-7	Plant A. Effect of Chlorine on Priority Pollutant Concentrations 30
VII-8	Plant B. Effect of Chlorine on Priority Pollutant Concentrations 31
VII-9	8-Hour Composites vs. Metals Concentrations 32

16<

LIST OF FIGURES

Number	Title	
IV-1	Influent Sampling Point at Plant A	9
IV-2	Prechlorinated Effluent Sampling Point Plant B	11
IV-3	Final Effluent Sampling Point Plant B	12
V-1	Automatic Sampler	14

17<

I. SUMMARY AND CONCLUSIONS

Summary

The purpose of this report is to present the results of a two-plant pilot study designed to determine future operating parameters to be used during a study of the fate of priority pollutants in publicly owned treatment works (POTW's). The scope of the overall project is anticipated to encompass 7-day, 24-hour sampling at 40 strategically located POTW's, representing a variety of municipal treatment technologies, size ranges, and percentages of industrial flow. A major goal of the project is to characterize the impact of toxic pollutants, from all sources, on POTW operations. In addition the effect of secondary treatment on priority pollutants will be studied.

The pilot study was conducted at two POTW's with significantly different characteristics. These two plants provided contrasts in many areas, including size, percent industrial flow, age, operation, sludge conditioning methodology, and capacity utilized.

During the two-plant program the analytical and logistical factors of field sampling were tested to determine the optimum field methodologies and also to ascertain the feasibility of studying other aspects of POTW operations. Additionally, preliminary information regarding the incidence, impact and fate of priority pollutants in POTW's was developed. The data obtained from this study will impact the pretreatment regulations for indirect dischargers as to credits allowed (if any) for acceptable treatability or removal of toxics in POTW's.

Conclusions

1. A significantly higher incidence of organic priority pollutants was observed at the more industrial Plant A as compared to the essentially non-industrial Plant B.

2. Seven of nine metallic priority pollutants were found to have higher average concentrations in the Plant A influent.

3. Of nine organic priority pollutants measured in Plant A's influent at an average concentration greater than 10 µg/l, eight were reduced by a minimum of 50 percent. Organic priority pollutants at Plant B occurred at such low levels that percent removal data could not be determined.

4. Metallic priority pollutants were removed over a broad range of efficiencies at both plants.

5. The following priority pollutants were concentrated in the residues generated at Plant A: cadmium, copper, lead, nickel, zinc, acenaphthene, dichlorobromomethane, 1,2-benzanthracene, 3,4-benzofluoranthene, fluorene and pyrene. Similarly, at Plant B, chromium, copper, lead, nickel, zinc, acrylonitrile, dichlorobromomethane and 3,4 benzofluoranthene were concentrated in the sludge.

6. Refractory, but volatile organic priority pollutants such as benzene, 1,1,1-trichloroethane, ethylbenzene, toluene and trichloroethylene were well removed but not concentrated in plant sludges, suggesting air stripping as a possible removal mechanism.

7. Daily variation of influent metallic priority pollutant concentrations was observed at both POTW's, but the variation was most pronounced at Plant A. Metals concentrations increased during the latter parts of the work week and dipped during weekends. Similar effects were recorded for conventional pollutants, but, in general, for organic priority pollutants, levels were too low to permit observation of trends.

8. The 8-hour versus 24-hour composite experiment that was carried out on the Plant A influent showed that there was no appreciable difference between daily concentration values of organic priority pollutants. However, at the more industrial Plant A, metals concentrations were found to be significantly higher during the 0800 to 1600 (8:00 a.m. to 4:00 p.m.) period.

9. Sampling and analysis of prechlorinated effluent samples produced evidence that formation of toxic chlorinated hydrocarbons in chlorine contact chambers and receiving streams does occur.

10. The mass loading of priority pollutants in the floatables and sludge filtrate was found to be very small, as compared to the mass loading in total POTW residues.

II. INTRODUCTION

The United States Environmental Protection Agency (EPA) has initiated a program to study the occurrence and fate of 129 selected toxic organic and inorganic pollutants (priority) pollutants) by means of a sampling program, at 40 publicly owned treatment works (POTW's). The first phase of this work was a pilot study at two POTW's to select the parameters of interest and establish detailed technical procedures that will be used for the overall project. In this report, data obtained from the two POTW's selected for the pilot study are presented. Since these two plants have different proportions of industrial flow, the relationship between industrial contributions and priority pollutant levels in POTW influents is examined. Additionally, other specific phenomena were studied, including the overall removal of toxic pollutants, removal mechanisms, concentration of toxic pollutants in sludge and the formation of chlorinated hydrocarbons during chlorine disinfection. EPA protocol[1] for collection, sampling and analysis of priority pollutants was followed for each procedure performed in the study, except where noted. Details of specific goals of the pilot study are outlined below.

Establishment of Sampling Techniques

An effort was made during sampling at the pilot facilities to determine the procedure best suited for obtaining the most representative samples from each treatment plant over the course of the entire 40-plant program. The effort focused on determining an appropriate sample frequency for obtaining the most representative picture of wastewater fluctuations which occur at a typical sewage treatment facility, as well as determining which days would yield the most representative samples, should the final sampling plan be limited to less than seven days of sampling per week.

Establishment of Appropriate Sampling Points

Determination of the appropriate sampling points to be used in the remainder of the 40-plant program was another focus of the pilot study. Samples were taken at different intermediate points in the wastewater treatment processes to ascertain which sampling points would provide the best information on the fate of priority pollutants as they pass through the POTW.

---

[1] Guidelines Establishing Test Procedures for the Analysis of Pollutants. To be published in the *Federal Register*. Proposed Amendments to 40 CFR Part 136.

20<

Development of Analytical Protocol for Samples

Another goal of the pilot study was to provide samples to be used in analytical protocol development. The present EPA protocol for the analysis of industrial wastewater samples is not specifically suitable for evaluation of municipal wastewater or sludge samples. For example, analytical techniques for municipal sludges, which are characterized by high solids content, require different techniques from those required for the cleaner effluent streams or industrial wastewaters for which the protocols were originally developed. To assure that repeatable and accurate results are obtained throughout the duration of the 40-plant study, the samples collected during the pilot work were provided to analytical laboratories for the experimental development of new protocol procedures. Replicate analyses were completed using different methods in order to develop appropriate procedures to be used for the full study.

Fate of Priority Pollutants in POTW's

A further goal of the pilot program was to develop preliminary conclusions on the fate of the priority pollutants in POTW's. These conclusions will be substantiated as the sampling progresses through the 40-plant schedule and a detailed technical report will be forthcoming after completion of the project.

III. PLANT SELECTION

For the pilot study, two conventional activated sludge facilities were chosen for evaluation. Plant A is a 120 Mgal/d design capacity plant with approximately 70 percent of its organic loading and 30 percent of its flow contributed by industry, while Plant B is a 15 Mgal/d design capacity plant with approximately 2 percent industrial flow.

The following is a characterization of the two POTW's sampled during the pilot study.

Plant A

The design capacity of Plant A is 300 Mgal/d primary flow and 120 Mgal/d secondary flow. Under normal dry weather conditions, the flow through this system varies between 85 percent to 90 percent of its secondary capacity. During the first week of sampling at the plant, the flow averaged only 91.0 Mgal/d.

The original primary treatment facility was constructed in 1924, and most of the sewers are as old or older than the primary system. It is estimated that the collection system is 60 percent separate sewers and 40 percent combined sewers.

The treatment unit operations at this conventional activated sludge POTW begin with gravity flow from the drainage area to the bar screens and grit chambers, from which lift pumps elevate the wastewater for gravity flow through the rest of the plant. After the lift pumps, the wastewater passes through pre-aeration, primary settling, clarification, and into the aeration chambers. After aeration, clarification, and chlorination, the wastewater is discharged to a local stream.

Sludge handling at this POTW involves primary sludge thickening by gravity thickeners, secondary sludge thickening by dissolved air flotation (DAF), vacuum filtration and incineration. During the sampling period at Plant A, the primary sludge flow averaged 325,000 gal/d and the secondary (waste activated) sludge flow averaged 1.5 Mgal/d.

Industrial contributions to the flow are primarily from several major industries: pharmaceutical manufacture, petrochemicals, plating operations, and automotive foundries. Also contributing to Plant A's sewage collection system are some coking operations and some food processing plants.

Plant B

The design capacity of Plant B is 15 Mgal/d, but under normal operations between 8 and 10 Mgal/d receive secondary treatment. During the sampling period of this pilot study the influent flow to the facility averaged 8.09 Mgal/d (56,635,000 gallons during the period August 6 to 13, 1978). This 18-year-old treatment facility (updated and expanded most recently in 1973) is designed for a discharge with an effluent quality of not more than 10 mg/l biochemical oxygen demand and 12 mg/l of suspended solids. The average biochemical oxygen demand and total suspended solids discharges during the week of sampling were 25 mg/l and 19 mg/l, respectively.

22<

The treatment unit operations utilized at this conventional activated sludge facility are as follows: Wastewater flows from the sewer system to a diversion chamber from which it is pumped to a height which allows gravity flow to the rest of the plant. The wastewater then passes through parallel detritus tanks (grit chambers), comminutors, pre-aeration chambers and into the primary settling tank. After primary settling, wastewater flows to the aeration tanks, secondary settling, chlorination, and is discharged.

The primary sludge flow at this POTW is pumped to sludge holding tanks where it is combined with the thickened (via DAF) waste activated sludge. From this point, the combined sludge passes to the sludge conditioning facilities where it is heated and pressurized prior to vacuum filtration. The decant from the sludge conditioning system and the filtrate is either returned to the sludge conditioning building, or bled to the head of the aeration tanks. The filter cake is incinerated with the resulting ash being slurried to a diked lagoon on the plant property.

During the sampling period, the primary sludge flow averaged 29,400 gal/d (205,860 gallons over the 7-day period). Sludge was usually pumped once per 8-hour work shift, and samples were taken during each pumping. The waste activated sludge was usually wasted only one time per week; the one time it was pumped during the sampling period, a sample was collected after the pumping. The estimated flow during that one pumping was 8,000 gallons. (No accurate flow reading for this pumping was available.)

The sewer system for Plant B consists primarily of combined sewers, broken down into four main trunk lines covering the far sections of the 29.4-square mile (or 22.5 according to POTW handout) drainage area. The sewer lines are mostly concrete construction and average 20 years in age, with some lines being over 50 years old. The age of the sewer lines accounts for the estimate that as much as 40 to 50 percent of the total flow to the POTW can be attributed to infiltration in the subsystems and interceptors, according to the facilities plan, completed under the authority of Section 201 of the Clean Water Act (PL 95-217).

The industrial contribution to the wastewater flow to Plant B can be considered minimal, because the areawide waste treatment management plan under Section 208 of the Clean Water Act lists the zoning breakdown of the drainage area as 96.6 percent residential, 1.0 percent retail business and offices, and 2.4 percent industrial. The industries associated with this drainage area are grain elevators, oil and fuel terminals, machine tool and metalworking companies, box and insulation companies, and one major chemical facility with its own National Pollutant Discharge Elimination System (NPDES) discharge permit. With such a small industrial flow, Plant B is considered to give a general approximation of a typical residential treatment facility.

IV. SAMPLE POINT DESCRIPTION

In an effort to determine the priority pollutant loads on the different waste streams within the two POTW's studied, several additional sample points were selected that would not normally be evaluated. The results of these analyses will be discussed in a following section of this report.

At Plant A, nine sampling points were used, as listed in Table IV-1. Samples were taken on seven consecutive days at the major points (influent, sludges, effluent), and an additional seven consecutive days at the influent only. (Extra influent samples were taken for analyses of 8-hour versus 24-hour compositing of influent. See Section VII.)

TABLE IV-1. SAMPLING FREQUENCY AT PLANT A

Point	Collection Method	Grabs for VOA, O&G Cn and Phenol	Type of Composite Samples	Duration
Influent	Automatic Sampler	6 times daily	3, 8-hr composites	7 days
Effluent before Chlorination	Automatic Sampler	6 times daily[1]	24 hr	days 5-7[2]
Final Effluent	Automatic Sampler	6 times daily	24 hr	7 days
Primary Sludge	Manual Composite	6 times daily[3]	24 hr	7 days
Secondary Sludge	Automatic Sampler	6 times daily[3]	24 hr	7 days
Floatables (scum)	Manual Composite	6 times daily[3]	24 hr	7 days
Combined Sludge	Manual Composite	None (proportion of primary secondary)	24 hr	7 days
Tap Water	One Time Grab	One Time Grab	N/A	1 day
Vacuum Filter Filtrate	One Time Grab	One Time Grab	N/A	1 day

[1] Volatile organic analysis (VOA) grabs only

[2] Chlorination system was not operative day 1, and had chlorine leaks days 2, 3, 4

[3] Composited by laboratory

24<

At Plant B, seven separate waste streams were sampled, as listed in Table IV-2. As at Plant A, seven days of sampling were undertaken at Plant B to observe variations over the course of a complete week.

Each sample point that was chosen best characterized the wastewater at a particular stage of treatment. An effort was made to choose the sample points in such a way that any extraneous factors which might affect the validity of the sample would be eliminated. This involved selecting sampling points that allowed collection of samples before settling, volatilization, or contamination from other waste streams could occur. In instances where more than one parallel stream flowed through the same treatment process, the sample was taken at the junction of the parallel streams if it was accessible. In all sampling, the EPA procedure for obtaining screening samples was used as the guide for gathering samples, and any deviation from the aforementioned procedure was documented.

The individual sampling points used at Plant A and nature of the wastewater that was sampled were as follows:

Plant A

Influent

Influent samples were obtained from one of four parallel flow grit chambers (usually only two in operation at one time) after the bar screens. The influent flow to Plant A was pumped to a wet well. From there it flowed by gravity and was split into several parallel streams prior to passing through the bar screens and into the grit chamber. An automatic sampler was set up at the grit chamber (Figure IV-1) to draw equal aliquots over the 8-hour composite period during the first week and over the 24-hour composite period during the second week. Tubing for the samples was positioned inside a fixed conduit which was mounted to the safety railing around the grit chambers in such a way that the conduit could be adjusted vertically to keep the submerged end approximately one foot below the surface of the flow in the grit chamber. The daily flow fluctuations and the adjustments and openings and closings of the other grit chambers would affect the level of the flow in the grit chamber from which the sample was being extracted. Thus, to keep the exposed end of the

TABLE IV-2. SAMPLING FREQUENCY AT PLANT B.

Point	Collection Method	Grabs for VOA, O&G Cn and Phenol	Type of Composite Samples	Duration
Influent	Automatic Sampler	6 times daily	24 hr	7 days
Effluent before Chlorination	Automatic Sampler	6 times daily	24 hr	7 days
Final Effluent	Automatic Sampler	6 times daily	24 hr	7 days
Combined Sludge	Manual Composite	3 times daily[1]	24 hr	7 days
Secondary Sludge	One Time Grab	One Time Grab	N/A	1 day
Secondary Sludge after DAF thickening	One Time Grab	One Time Grab	N/A	1 day
Tap Water	One Time Grab	One Time Grab	N/A	1 day

[1] Composited by laboratory

Figure IV-1. Influent sampling point at Plant A.

sample tubing below the top layer of wastewater flow, the conduit was checked and adjusted, if necessary, at least once every four hours. Samples for the fractions that were not automatically composited were grabbed via a glass dipping pitcher at the sample midstream point where the tubing was positioned. Influent flow readings were supplied by the treatment plant after the sampling period was complete.

Primary Sludge

Samples for the primary sludge were taken from the main line between the primary settling tanks and the sludge conditioning system. Samples were taken every four hours for both the composites and the grabs, with the composite portion of the sample being held in a 3-gallon container and kept on ice at the sample point. A sludge flow totalizer was located adjacent to the sample valve and provided sludge flow information for each sample period.

Floatables (Scum)

The floatables samples, which were taken from the primary settling tanks, represented the material which had been skimmed off the tanks and had accumulated at the discharge end of the primaries. These samples were obtained by manually dipping into this floating layer each sample period.

Secondary (Waste Activated) Sludge

The secondary sludge samples were taken from a lift pump tower. This tower provided the only access point to the secondary sludge before it flowed (by gravity) to the DAF thickener. An automatic sampler was set up on this tower to obtain the composite samples. Totalizer readings were read at the secondary control building and were recorded for each sample period.

Combined Sludge

The combined sludge sample was a flow-proportioned composite sample of the primary and waste activated sludges. A total of 1600 ml of sludge was composited for each 4-hour grab sample period. The ratio of primary sludge to waste activated sludge was determined by the flow rate of each sludge during the preceding four hours. Each sludge allotment was measured in a graduated beaker and transferred to a 3-gallon container for storage in an ice bath for the 24-hour sample period.

Pre-chlorinated Effluent

Samples of the pre-chlorinated effluent were taken immediately upstream of the chlorination point. The chlorine is added to the effluent stream underground, and a piece of conduit was positioned at the sample point with the instream end upstream of the chlorine contact point. Chlorination facilities were not operational during the first few days of the sampling and, consequently, no samples of the pre-chlorinated effluent were obtained until July 26. Once the sampling was begun at this point, a small chlorine gas leak developed, and it was judged unsafe to enter the 10-foot access hole to gather the grab samples. To remedy this problem, an additional sampler was set up to collect the grab fraction samples (volatile organic analyses—VOA's only) from the stream and deliver them to the surface.

Final Effluent

The final effluent sample point was located at the discharge end of the chlorine contact chamber, just prior to the overflow weir to the river. Composite samples, where appropriate, were collected with an automatic sampler, utilizing a conduit to fix the intake tube's position.

Vacuum Filter Filtrate

One grab sample was taken of the vacuum filter filtrate from the vacuum discharge line in the filter building. (All sample bottles were filled as grabs at this one time.) Each filling yielded approximately 250 ml of sample. No values for the flow of this waste stream were available.

Tap Water

A single grab sample for all parameters was taken of the tap water in the Plant's laboratory sink. The sample point was considered representative of the city water supply.

The individual sampling points at Plant B and the nature of the wastewater sampled are as follows:

Plant B

Influent

The influent sample point was at the head end of the grit chambers (detritus tanks). At this point an automatic sampler was set up with the sample tubing secured inside a stationary conduit so as to maintain the wetted end in a position in the center of the turbulent zone. This area was subject to surges of wastewater flow, and a secure placement of the tubing was the only way to obtain a representative sample of the influent. The grab fractions for the influent were obtained via a glass pitcher which was dipped directly into the wastewater. Flow readings of the influent flow rates were supplied by the treatment plant after the sampling period had been completed. Additional parallel sampling at the sampling point was done by another EPA contractor who is also sampling wastewater collection systems for priority pollutants.

Combined Sludge

The combined sludge sample was to be a flow composite of the primary sludge and the secondary sludge, but until the last day of sampling, there was no secondary sludge being wasted. Thus, the sludge sample for the first six of seven days was only primary sludge, and the seventh sample was a flow-proportioned composite of both the primary and secondary sludges.

The primary sludge sample point was a tap off of the sludge pump which was used to transport the primary sludge from the raw sludge well to the sludge holding tanks. The pumping of the sludge was not a continuous operation and required that samples be taken during the three daily pumping periods. The samples were grabbed from the tap on the pump (after an appropriate purge time) after an initial startup period of between 10 and 15 minutes and before the end of the pumping period when the sludge would become too watery to yield a representative sample. The primary sludge flow was read in the sludge pumping building each time a sample was grabbed.

The secondary sludge samples were taken only on the last day of sampling, as this was the only time during the 7-day sampling period when any secondary sludge was wasted. Two samples of the secondary sludge were grabbed, one before and one after the thickening process. With each sample, an appropriate amount (by flow) was composited with the primary sludge sample for that time period. The secondary sludge sample prior to thickening was grabbed as it flowed into the holding tank (after pumping from secondary clarifiers). The secondary sludge sample, after thickening, was grabbed by dipping into the surface layer of thickened sludge on the discharge end of the sludge thickening unit. No accurate flow measurements of the flow of this secondary sludge were available. Therefore, an operator estimate was used for the flow information.

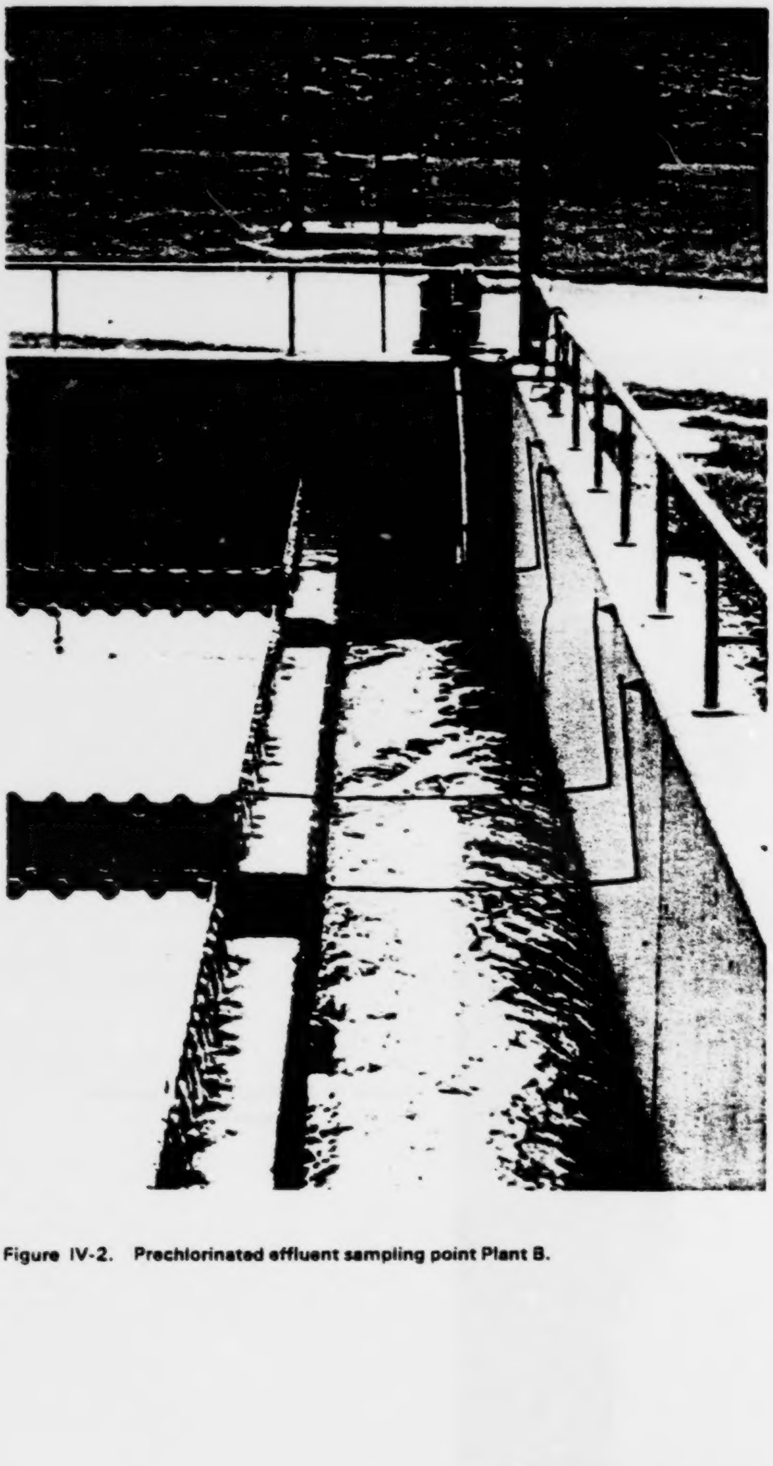


Figure IV-2. Prechlorinated effluent sampling point Plant B.

Pre-chlorinated Effluent

The pre-chlorinated effluent sample point was located in the discharge trough of the secondary clarifiers after all the flows of the clarifiers had converged and were flowing to the chlorination chamber. An automatic sampler was set up at this point (Figure IV-2) to obtain the composite sample. The automatic sampler tubing was also secured with conduit facing into the wastewater flow. The grab samples were taken at the same sample point.

Final Effluent

The final effluent sampling point was at the overflow weir of the chlorine contact chamber just prior to the flow into the discharge flume (Figure IV-3). The sample point was approximately 20 feet below ground level, and samples were collected with an automatic sampler and a glass beaker dipping pole. As with the other automatic sampler points, the sampler tubing was rigidly held by a fixed piece of conduit facing upstream.

Tap Water

One tap water sample was taken at Plant B to obtain background information on the city water supply. The sample point chosen was the water tap in the sludge concentration tank's control building, which was being used as a staging area by the sampling crew. Each of the sample bottles was filled directly from the tap.

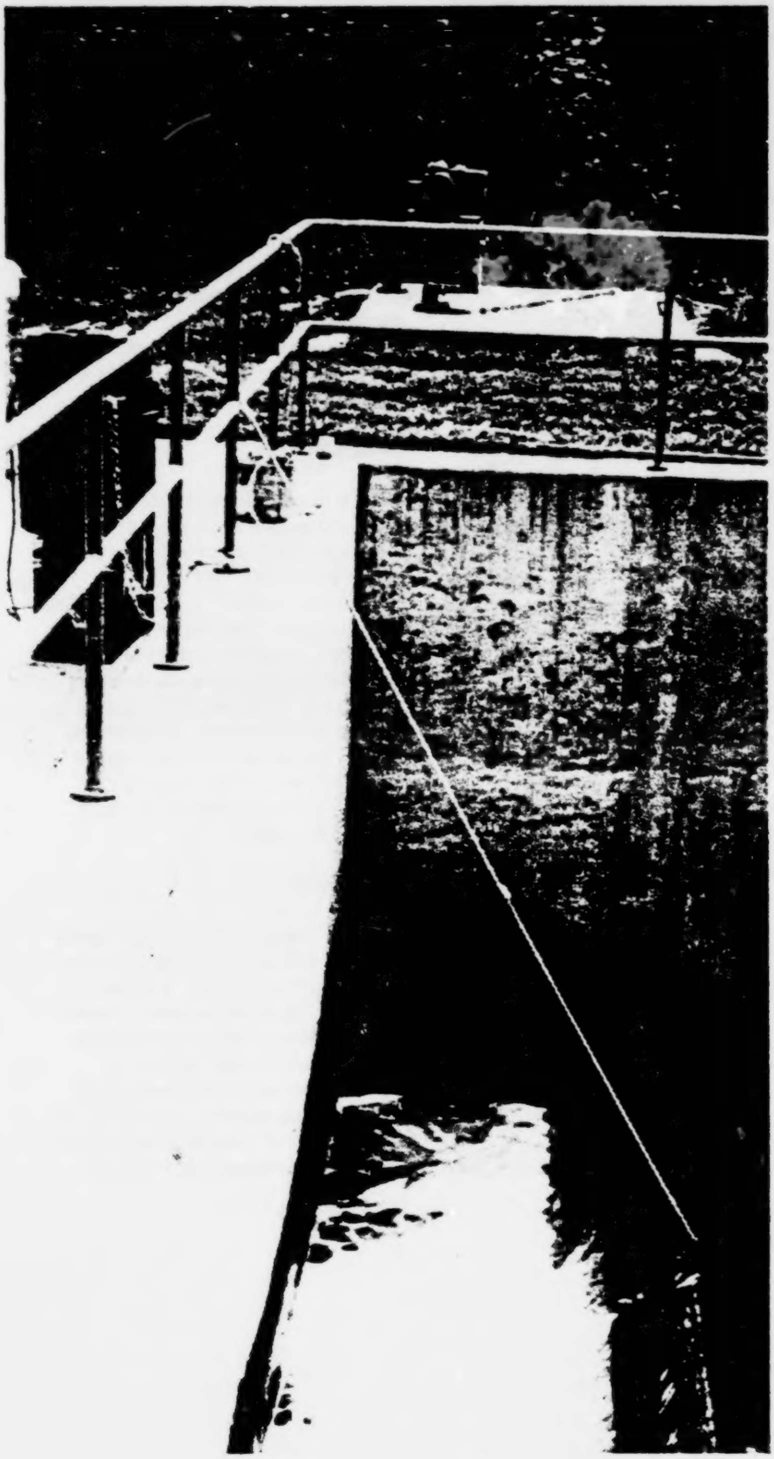


Figure IV-3. Final effluent sampling point Plant B.

V. SAMPLING

Sampling Frequency

The sampling activities at both of the pilot study POTW's were scheduled over a 1-week period so that information could be gathered on operational and pollutant loading variations on individual days.

Sampling at Plant A spanned 14 days, Saturday, July 22, 1978 to Saturday, August 5, 1978, with the general all-points sampling taking place only during the first seven days and sampling of the influent only during the second seven days. Similarly, at Plant B, the seven days of sampling were Sunday, August 6, 1978 to Sunday, August 13, 1978.

To obtain a cross section of pollutant levels through the treatment plants, multiple grabs were taken during each 24-hour sampling period (0800-0800). As a result, grab samples were taken six times daily (1000, 1400, 1800, 2200, 0200, 0600). During the second week at Plant A when only the influent was being sampled, grab times were moved ahead two hours to coincide with the 24-hour composite (0800, 1200, 1600, 2000, 2400, 0400).

Sampling Techniques

Identical sampling techniques were used at both POTW's throughout the study, and unless noted below, sampling protocols developed by the EPA were followed.

To obtain the most representative sample from each sample point, automatic samplers (Figure V-1) were used wherever possible to gather frequent, equal-sized sample aliquots. This procedure was only possible where flows were continuous and accessible to automatic sampling equipment. At each POTW, the influent and effluent streams were easily accessible and could be sampled at points where the flow was representative of the total plant influent and effluents, respectively. On the other hand, a sample point for primary sludge at Plant A posed special problems where waste flow was confined to a pipe; thus, as a result, the only feasible method for retrieving a sample involved opening a gate valve. Because the valve tended to clog, repeated opening and closing was required to avoid backups or blockages. For such sample points manual compositing had to be employed. Each sample point presented its own peculiarities and had to be handled individually. No single standard technique coud be developed to cover all sample points under all situations.

Sample Collection Procedures

For those samples which could be collected using automatic samplers, tubing was changed once per day, and sampler blanks were run at the beginning of each day's new composite. The automatic samplers were calibrated to pull sample aliquots of at least 100 ml at time intervals not to exceed 30 minutes. Composites in the automatic samplers were collected in 2.5-gallon glass jars which were kept in an ice bath at 4°C for the entire 24-hour period of sampling.

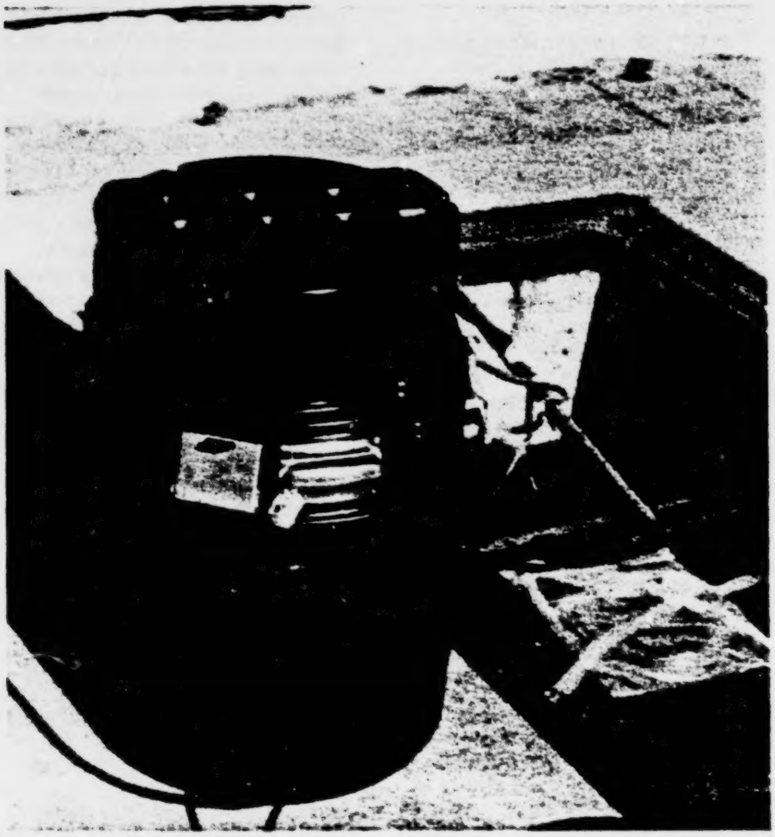


Figure V-1. Automatic sampler.

For those composite samples which could not be gathered by automatic samplers, aliquots were taken with the regular grab samples and composited into jugs which were kept in an ice bath at 4°C.

At sample points in the two pilot study POTW's, except for the two tap water sample points and the vacuum filter filtrate sample point at Plant A, the sample containers were filled via an intermediate gathering beaker of glass or stainless steel. The intermediate beakers were used to obtain the most representative sample, while maintaining accuracy and safety. Safety was an important factor, since many sampling points were constructed in a fashion that precluded direct collection of grab samples. Stainless steel and glass beakers were used exclusively as the intermediate beakers because these two materials are defined in the EPA sampling protocol as having characteristics such that they will not contaminate the samples, nor will they contribute any extra pollutants by deterioration or breakdown that might be detected in the wastewater analysis. Each sample point at each plant had its own beaker to eliminate cross contamination, and each sampling container was thoroughly rinsed with new sample prior to each sample collection.

At the two tap water sample points the flow from the taps could be regulated so as to facilitate direct filling of the sample containers. At the vacuum filter filtrate sample point in Plant A, the only way to obtain a sample was off of the vacuum line. By inserting a plastic bottle (which had been used repeatedly for this purpose) into an exposed air port, a disruption of the vacuum caused some of the filtrate to be deposited in the bottle. This plastic bottle was thoroughly rinsed with sample prior to each use.

Protocol and Protocol Modifications

Samples from both plants were collected in accordance with EPA protocols, including the proper preparation of bottles, the addition of prescribed preservatives and the collection of appropriate sampler blanks. All samples were shipped by air to the appropriate laboratories within prescribed time limits and were analyzed according to protocols for organic analysis. Metals from influent and effluent samples were analyzed according to protocols developed by EPA for priority pollutants. Metals from influent and effluent samples were analyzed by EPA's Region VII laboratory, using Plasma Atomic Emission Spectroscopy supplemented with flameless atomic absorption spectrophotometry, where appropriate. Organic priority pollutants from influent and effluent samples were analyzed by an EPA contract laboratory utilizing liquid-liquid extraction and gas chromatography-mass spectroscopy (gc-ms) for the acid and base neutral fractions, electron capture gas chromatography for pesticides, and purge and trap followed by gc-ms for volatile organics. All sludge samples were analyzed bv the EPA contractor laboratory who developed some of the specific protocols for priority pollutant analysis of sludge samples during the study. Conventional pollutant analyses for all samples were performed by a branch office of this same laboratory in a different city.

The aforementioned protocol was followed as closely as possible during the pilot study but, in certain instances, modifications were required to suit individual sampling situations. Specific modifications to the protocol are discussed below.

The protocol states that Teflon tubing should be used on all automatic sampler applications. For this initial screening vinyl tubing was used instead. This tubing was thoroughly purged with distilled water prior to its use, and a sampler blank was run on each piece of tubing daily at each site before the sampler was started.

The method of grabbing samples via an intermediate vessel is a modification to the protocol for fractions such as oil and grease, where the sample container is supposed to be filled directly from the wastewater stream. This modification was made for safety and practical reasons since positioning of the sample container into most of these waste streams was either impossible or very dangerous, and the induced error through use of an intermediate beaker was of lesser consequence. In all cases where an intermediate beaker was used, it was used exclusively at one point for the duration of sampling at the plant, and it was repeatedly purged with fresh sample at each sample period.

VI. DATA SUMMARY

Major Trends

The priority pollutants detected in the influents, effluents, and sludges of the two pilot POTW's are depicted in Tables VI-1 and VI-2. These tables point out the predominance of the solvents and the phthalates in the influents. In Plant A's influent, eight of the ten most prominant pollutants were solvents, with only one phthalate and phenol detected in more than 80 percent of the samples. In Plant B, the smaller industrial contribution is evident in that only six of the ten most prominent pollutants are solvents, with the remaining four being phthalates. Phenol was not among the ten most common pollutants at Plant B.

The sludge and effluent data in these tables also show that many priority pollutants are concentrated in residues, while others are removed by different mechanisms.

The occurrence of selected conventional and priority pollutants in Plant A's influent, effluent and sludges is presented in Section VII. The organic pollutants with the highest concentration in the influent were benzene, 1,1,1 trichloroethane, chloroform, ethylbenzene, bis (2-ethylhexyl) phthalate, tetrachloroethylene, toluene and trichloroethylene. All of these parameters were reduced by an average of 50 percent or more during treatment, and all except chloroform were detected in one or more of the sludges. Metallic priority pollutants which occurred at relatively high levels in Plant A's influent included chromium, copper, lead, nickel and zinc. These metals were all reduced at least 50 percent during treatment, and all were detected at high levels in both the primary and secondary sludge.

A data summary of the weekly average concentration of selected conventional and priority pollutants from Plant B is presented in Section VII. No organic priority pollutant occurred at an average of over 20µg/l in the plant's influent. The organic pollutants which were present in the highest concentrations, however, were benzene, methylene chloride, and bis (2-ethylhexyl) phthalate. Methylene chloride values must be viewed with some suspicion since this substance was used as a bottle preparation additive. Metallic priority pollutants which were present at over 50µg/l in the influent included chromium, copper, cyanide and zinc. (For this discussion, cyanide has been classified as a metallic priority pollutant.)

TABLE VI-1
SUMMARY
PERCENT OCCURENCES OF ORGANIC PRIORITY POLLUTANTS
PLANT A

5-30-79

PP	PARAMETER NAME	INFLUENT SAMPLES ANALYZED	INFLUENT TIMES DETECTED (PERCENT)	FINAL EFFLUENT SAMPLES ANALYZED	FINAL EFFLUENT TIMES DETECTED (PERCENT)	PRIMARY SLUDGE SAMPLES ANALYZED	PRIMARY SLUDGE TIMES DETECTED (PERCENT)	SECONDARY SLUDGE SAMPLES ANALYZED	SECONDARY SLUDGE TIMES DETECTED (PERCENT)
86	TOLUENE	41	41(100)	40	38(95)	7	7(100)	7	2(29)
44	METHYLENE CHLORIDE	41	41(100)	40	39(98)	7	7(100)	7	7(100)
87	TRICHLOROETHYLENE	41	40(98)	40	36(90)	7	7(100)	7	1(14)
85	TETRACHLOROETHYLENE	41	40(98)	40	39(98)	7	7(100)	7	5(71)
23	CHLOROFORM	41	40(98)	40	39(98)	7	0(0)	7	0(0)
4	BENZENE	41	40(98)	40	18(45)	7	7(100)	7	4(57)
66	BIS(2-ETHYLHEXYL) PHTHALATE	21	20(95)	7	7(100)	7	6(86)	5	2(40)
65	PHENOL	21	20(95)	7	7(100)	7	2(29)	5	1(20)
38	ETHYLBENZENE	41	37(90)	40	25(63)	7	7(100)	7	2(29)
11	1,1,1-TRICHLOROETHANE	41	35(85)	40	30(75)	7	4(57)	7	0(0)
29	1,1-DICHLOROETHYLENE	41	32(78)	40	33(83)	7	2(29)	7	0(0)
68	DI-N-BUTYL PHTHALATE	21	16(76)	7	4(57)	7	0(0)	5	0(0)
55	NAPHTHALENE	21	16(76)	7	3(43)	7	5(71)	5	1(20)
30	1,2-TRANS-DICHLOROETHYLENE	41	31(76)	40	7(18)	7	3(43)	7	0(0)
81	PHENANTHRENE	21	15(71)	7	3(43)	7	6(86)	5	2(40)
78	ANTHRACENE	21	15(71)	7	3(43)	7	6(86)	5	2(40)
70	DIETHYL PHTHALATE	21	13(62)	7	2(29)	7	0(0)	5	0(0)
25	1,2-DICHLOROBENZENE	21	9(43)	7	1(14)	7	0(0)	5	0(0)
71	DIMETHYL PHTHALATE	21	8(38)	7	1(14)	7	0(0)	5	0(0)
67	BUTYL BENZYL PHTHALATE	21	8(38)	7	3(43)	7	1(14)	5	0(0)
27	1,4-DICHLOROBENZENE	21	8(38)	7	2(29)	7	0(0)	5	0(0)
84	PYRENE	21	7(33)	7	4(57)	7	6(86)	5	0(0)
80	FLUORENE	21	6(29)	7	1(14)	7	3(43)	5	0(0)
64	PENTACHLOROPHENOL	21	6(29)	7	1(14)	7	1(14)	5	1(20)
39	FLUORANTHENE	21	6(29)	7	3(43)	7	0(0)	5	0(0)
26	1,3-DICHLOROBENZENE	21	5(24)	7	1(14)	7	0(0)	5	0(0)
13	1,1-DICHLOROETHANE	41	8(20)	7	0(0)	7	4(57)	5	0(0)
7	CHLOROBENZENE	41	6(15)	40	1(3)	7	0(0)	7	0(0)
76	CHRYSENE	21	2(10)	7	1(14)	7	6(86)	5	0(0)
72	1,2-BENZANTHRACENE	21	2(10)	7	1(14)	7	6(86)	5	0(0)
43	BIS(2-CHLOROETHYOXY) METHANE	21	2(10)	7	0(0)	7	0(0)	5	0(0)
6	CARBON TETRACHLORIDE	41	4(10)	40	0(0)	7	2(29)	7	2(29)
1	ACENAPHTHENE	21	2(10)	7	0(0)	7	0(0)	5	0(0)
14	1,1,2-TRICHLOROETHANE	41	3(7)	40	0(0)	7	0(0)	7	0(0)
83	INDENO(1,2,3-C,D) PYRENE	21	1(5)	7	1(14)	7	0(0)	5	1(20)
82	1,2:5,6-DIBENZANTHRACENE	21	1(5)	7	1(14)	7	0(0)	5	1(20)
79	1,12-BENZOPERYLENE	21	1(5)	7	0(0)	7	0(0)	5	0(0)
77	ACENAPHTHYLENE	21	1(5)	7	0(0)	7	0(0)	5	0(0)
69	DI-N-OCTYL PHTHALATE	21	1(5)	7	1(14)	7	0(0)	5	0(0)
52	HEXACHLOROBUTADIENE	21	1(5)	7	0(0)	7	0(0)	5	0(0)
45	CHLOROMETHANE	41	2(5)	40	0(0)	7	0(0)	7	0(0)
32	1,2-DICHLOROPROPANE	41	2(5)	7	0(0)	7	0(0)	40	0(0)
22	PARACHLOROMETA CRESOL	21	1(5)	7	0(0)	7	0(0)	5	0(0)
21	2,4,6-TRICHLOROPHENOL	21	1(5)	7	0(0)	7	0(0)	5	0(0)
9	HEXACHLOROBENZENE	21	1(5)	7	0(0)	7	0(0)	5	0(0)
8	1,2,4-TRICHLOROBENZENE	21	1(5)	7	0(0)	7	0(0)	5	0(0)
49	TRICHLOROFLUOROMETHANE	41	1(2)	40	2(5)	7	0(0)	7	0(0)
48	DICHLOROBROMOMETHANE	41	1(2)	40	9(23)	7	7(100)	7	6(86)
10	1,2-DICHLOROETHANE	41	1(2)	40	0(0)	7	0(0)	7	0(0)
74	3,4-BENZOFLUORANTHENE	21	0(0)	7	0(0)	7	5(71)	5	1(20)
51	CHLORODIBROMOMETHANE	41	0(0)	40	2(5)	7	3(43)	7	4(57)
34	2,4-DIMETHYLPHENOL	21	0(0)	7	1(14)	7	0(0)	5	0(0)
28	3,3'-DICHLOROBENZIDINE	21	0(0)	7	1(14)	7	0(0)	5	0(0)
24	2-CHLOROPHENOL	21	0(0)	7	1(14)	7	0(0)	5	0(0)
3	ACRYLONITRILE	41	0(0)	40	0(0)	7	0(0)	7	1(14)

NOTES: ALL UNITS UG/L UNLESS OTHERWISE SPECIFIED
PRIORITY POLLUTANTS NOT LISTED WERE NOT DECTED IN ANY SAMPLES

TABLE VI-2
SUMMARY
PERCENT OCCURENCES OF ORGANIC PRIORITY POLLUTANTS
PLANT B

5-30-79

		INFLUENT		FINAL EFFLUENT		COMBINED SLUDGE	
PP	PARAMETER NAME	SAMPLES ANALYZED	TIMES DETECTED (PERCENT)	SAMPLES ANALYZED	TIMES DETECTED (PERCENT)	SAMPLES ANALYZED	TIMES DETECTED (PERCENT)
67	BUTYL BENZYL PHTHALATE	6	6(100)	8	4(50)	7	0(0)
66	BIS(2-ETHYLHEXYL) PHTHALATE	6	6(100)	8	7(88)	7	7(100)
85	TETRACHLOROETHYLENE	42	41(98)	41	23(56)	7	6(86)
23	CHLOROFORM	42	40(95)	41	38(93)	7	0(0)
44	METHYLENE CHLORIDE	42	39(93)	41	39(95)	7	7(100)
70	DIETHYL PHTHALATE	6	5(83)	8	3(38)	7	0(0)
68	DI-N-BUTYL PHTHALATE	6	5(83)	8	5(63)	7	0(0)
25	1,2-DICHLOROBENZENE	6	5(83)	8	3(38)	7	0(0)
86	TOLUENE	42	32(76)	41	29(71)	7	6(86)
4	BENZENE	42	31(74)	41	10(24)	7	6(86)
69	DI-N-OCTYL PHTHALATE	6	4(67)	8	1(13)	7	0(0)
65	PHENOL	6	4(67)	8	7(88)	7	1(14)
55	NAPHTHALENE	6	4(67)	8	3(38)	7	3(43)
84	PYRENE	6	3(50)	8	0(0)	7	5(71)
81	PHENANTHRENE	6	3(50)	8	0(0)	7	5(71)
78	ANTHRACENE	6	3(50)	8	0(0)	7	5(71)
71	DIMETHYL PHTHALATE	6	3(50)	8	2(25)	7	0(0)
39	FLUORANTHENE	6	3(50)	8	0(0)	7	0(0)
38	ETHYLBENZENE	42	18(43)	41	2(5)	7	2(29)
29	1,1-DICHLOROETHYLENE	42	16(38)	41	14(34)	7	0(0)
87	TRICHLOROETHYLENE	42	14(33)	41	1(2)	7	0(0)
11	1,1,1-TRICHLOROETHANE	42	10(24)	41	1(2)	7	0(0)
64	PENTACHLOROPHENOL	6	1(17)	8	1(13)	7	0(0)
54	ISOPHORONE	6	1(17)	8	0(0)	7	0(0)
36	2,6-DINITROTOLUENE	6	1(17)	8	0(0)	7	0(0)
27	1,4-DICHLOROBENZENE	6	1(17)	8	0(0)	7	0(0)
26	1,3-DICHLOROBENZENE	6	1(17)	8	4(50)	7	0(0)
10	1,2-DICHLOROETHANE	42	5(12)	41	6(15)	7	0(0)
48	DICHLOROBROMOMETHANE	42	4(10)	41	11(27)	7	7(100)
51	CHLORODIBROMOMETHANE	42	3(7)	41	11(27)	7	2(29)
13	1,1-DICHLOROETHANE	42	2(5)	41	1(2)	7	0(0)
7	CHLOROBENZENE	42	2(5)	41	0(0)	7	0(0)
32	1,2-DICHLOROPROPANE	42	1(2)	41	0(0)	7	0(0)
77	ACENAPHTHYLENE	6	0(0)	8	2(25)	7	0(0)
76	CHRYSENE	6	0(0)	8	1(13)	7	2(29)
74	3,4-BENZOFLUORANTHENE	6	0(0)	8	0(0)	7	5(71)
72	1,2-BENZANTHRACENE	6	0(0)	8	1(13)	7	2(29)
58	4-NITROPHENOL	6	0(0)	8	2(25)	7	0(0)
57	2-NITROPHENOL	6	0(0)	8	3(38)	7	0(0)
28	3,3'-DICHLOROBENZIDINE	6	0(0)	8	1(13)	7	0(0)
3	ACRYLONITRILE	42	0(0)	41	0(0)	7	1(14)

NOTES: ALL UNITS UG/L UNLESS OTHERWISE SPECIFIED
PRIORITY POLLUTANTS NOT LISTED WERE NOT DECTED IN ANY SAMPLES

VII. ANALYSIS OF RESULTS

Fate of Priority Pollutants

Impact of Industrial Contribution on Influent Quality

As previously outlined, Plant A accepts a large proportion of its total flow from industrial sources, whereas Plant B treats practically no heavy industrial wastewater. Tables VII-1 and VII-2 summarize the individual influent data points for these two plants. An examination of the two tables shows a significantly higher incidence of priority pollutants in Plant A as compared to Plant B. In total, 52 organic priority pollutants were found in the Plant A influent, while in the Plant B raw wastewater only 33 were detected. Similarly at Plant A, 18 organic priority pollutants were measured at above the detection limit, but at Plant B only five were found at above detectable levels. It was also found that Plant A influent contained 21 organic priority pollutants which were absent in the Plant B influent; only two organic priority pollutants were found exclusively in the Plant B raw wastewater. Twenty organics found in both raw wastewaters had higher average concentrations in the Plant A influent, but only six organic priority pollutants common to both raw wastewater streams were more concentrated in the Plant B influent. It is also interesting to note that 13 of the 20 organics found at higher average concentrations in the predominantly industrial Plant A influent are solvents.

Nine metallic priority pollutants were detected in the influents to both plants. Seven of these were found to have higher average concentrations in both influents; only zinc was measured at a higher level in Plant B, as compared to Plant A influent. It should be noted that the traditional (conventional and non-conventional) pollutant parameters (BOD, COD, TSS, residue, etc.) were also consistently higher in the Plant A raw wastewater, as compared to the Plant B influent.

Removal of Priority Pollutants

Tables VII-3 and VII-4 depict percent removals for conventional, non-conventional and priority pollutants at Plants A and B. During the week of sampling, Plant A achieved good removals of conventional pollutants. BOD was reduced from an average influent concentration of 201 mg/l to 13 mg/l (94 percent) and TSS from 140 mg/l to 20 mg/l (86 percent). Priority pollutant metals that were present in detectable amounts were also removed reasonably well. Antimony, arsenic, beryllium, selenium and thallium were never found above their detection limits in influent or effluent samples and percent removals could not be calculated. Chromium and copper both were reduced to less than 50μg/l (90 and 86 percent removal, respectively). Cadmium, nickel, and zinc were removed somewhat less effectively (59 to 65 percent each, on an average). Lead and silver were both reduced to below their detection limits, accounting for the wide range shown in VII-3 for their percent removals. Nine organic priority pollutants were detected in Plant A's influent at an average of over 10μg/l. Eight of the nine (benzene; 1,1,1-trichloroethylene; chloroform; ethylbenzene; bis(2-ethylhexyl)

TABLE VII-1
PERCENT OCCURENCES FOR PRIORITY POLLUTANTS 5/30/79

PLANT A SAMPLE POINT: INFLUENT

		NUMBER OF						
PP	PARAMETER	SAMPLES ANALYZED	TIMES DETECTED (PERCENT)	TIMES DETECTED ABOVE MIN.	AVERAGE	MEDIAN	MINIMUM	MAXIMUM
1	ACENAPHTHENE	28	2(7)	0(0)	0- 1	N-D	N-D	LT 10
4	BENZENE	82	81(99)	45(55)	288- 292	37	N-D	5600
6	CARBON TETRACHLORIDE	82	6(7)	1(1)	0- 1	N-D	N-D	39
7	CHLOROBENZENE	82	9(11)	0(0)	0- 1	N-D	N-D	LT 10
8	1,2,4-TRICHLOROBENZENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
9	HEXACHLOROBENZENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
10	1,2-DICHLOROETHANE	82	1(1)	0(0)	0- 1	N-D	N-D	LT 10
11	1,1,1-TRICHLOROETHANE	82	71(87)	45(55)	15- 18	10	N-D	220
13	1,1-DICHLOROETHANE	82	19(23)	0(0)	1- 2	N-D	N-D	LT 10
14	1,1,2-TRICHLOROETHANE	82	3(4)	1(1)	LT 3	N-D	N-D	270
21	2,4,6-TRICHLOROPHENOL	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
22	PARACHLOROMETA CRESOL	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
23	CHLOROFORM	82	79(96)	67(82)	43- 44	21	N-D	440
25	1,2-DICHLOROBENZENE	28	15(54)	0(0)	1- 5	LT 10	N-D	LT 10
26	1,3-DICHLOROBENZENE	28	6(21)	0(0)	1- 2	N-D	N-D	LT 10
27	1,4-DICHLOROBENZENE	28	14(50)	0(0)	1- 5	LT 5	N-D	LT 10
29	1,1-DICHLOROETHYLENE	82	60(73)	5(6)	1- 7	LT 10	N-D	15
30	1,2-TRANS-DICHLOROETHYLENE	82	69(84)	18(22)	4- 11	LT 10	N-D	64
32	1,2-DICHLOROPROPANE	82	2(2)	0(0)	0- 1	N-D	N-D	LT 10
38	ETHYLBENZENE	82	75(91)	28(34)	21- 27	LT 10	N-D	890
39	FLUORANTHENE	28	8(29)	0(0)	1- 2	N-D	N-D	LT 10
43	BIS(2-CHLOROETHYOXY) METHANE	28	2(7)	0(0)	0- 1	N-D	N-D	LT 10
44	METHYLENE CHLORIDE	82	82(100)	20(24)	8- 16	LT 10	LT 10	100
45	CHLOROMETHANE	82	2(2)	0(0)	0- 1	N-D	N-D	LT 10
47	BROMOFORM	82	1(1)	0(0)	0- 1	N-D	N-D	LT 10
48	DICHLOROBROMOMETHANE	82	1(1)	0(0)	0- 1	N-D	N-D	LT 10
49	TRICHLOROFLUOROMETHANE	82	2(2)	0(0)	0- 1	N-D	N-D	LT 10
51	CHLORODIBROMOMETHANE	82	1(1)	0(0)	0- 1	N-D	N-D	LT 10
52	HEXACHLOROBUTADIENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
55	NAPHTHALENE	28	23(82)	1(4)	1- 8	LT 10	N-D	13
64	PENTACHLOROPHENOL	28	7(25)	0(0)	1- 2	N-D	N-D	LT 10
65	PHENOL	28	27(96)	9(32)	13- 19	LT 10	N-D	20(
66	BIS(2-ETHYLHEXYL) PHTHALATE	28	26(93)	14(50)	25- 29	5	N-D	250
67	BUTYL BENZYL PHTHALATE	28	11(39)	1(4)	1- 4	N-D	N-D	12
68	DI-N-BUTYL PHTHALATE	28	19(68)	1(4)	1- 8	LT 10	N-D	44
69	DI-N-OCTYL PHTHALATE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
70	DIETHYL PHTHALATE	28	17(61)	0(0)	1- 6	LT 10	N-D	LT 10
71	DIMETHYL PHTHALATE	28	11(39)	0(0)	1- 3	N-D	N-D	LT 10
72	1,2-BENZANTHRACENE	28	5(18)	0(0)	0- 1	N-D	N-D	LT 10
73	BENZO (A)PYRENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
76	CHRYSENE	28	5(18)	0(0)	0- 1	N-D	N-D	LT 10
77	ACENAPHTHYLENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
78	ANTHRACENE	28	21(75)	0(0)	1- 7	LT 10	N-D	LT 10
79	1,12-BENZOPERYLENE	28	1(4)	0(0)	0- 1	N-D	N-D	LT 10
80	FLUORENE	28	8(29)	0(0)	1- 2	N-D	N-D	LT 10
81	PHENANTHRENE	28	21(75)	0(0)	1- 7	LT 10	N-D	LT 10
82	1,2:5,6-DIBENZANTHRACENE	28	2(7)	0(0)	0- 1	N-D	N-D	LT 10
83	INDENO(1,2,3-C,D) PYRENE	28	2(7)	0(0)	0- 1	N-D	N-D	LT 10
84	PYRENE	28	10(36)	1(4)	3- 6	N-D	N-D	84
85	TETRACHLOROETHYLENE	82	81(99)	58(71)	47- 50	16	N-D	1500
86	TOLUENE	82	81(99)	56(68)	35- 38	13	N-D	440
87	TRICHLOROETHYLENE	82	81(99)	49(60)	28- 32	11	N-D	440
114	ANTIMONY	23		0(0)	1- 50	LT 50	LT 50	LT 50
115	ARSENIC	23		0(0)	1- 50	LT 50	LT 50	LT 50
117	BERYLLIUM	23		0(0)	1- 2	LT 2	LT 2	LT 2
118	CADMIUM	23		21(91)	LT 12	9	LT 2	39
119	CHROMIUM	23		23(100)	450	372	63	1360
120	COPPER	23		23(100)	191	154	35	864
121	CYANIDE	84		57(68)	124- 128	24	LT 10	1280
122	LEAD	23		16(70)	55- 61	41	LT 20	216
123	MERCURY	23		15(65)	0.0- 0.3	0.3	LT 0.2	0.8
124	NICKEL	23		22(96)	LT 98	66	LT 10	347
125	SELENIUM	23		0(0)	1- 50	LT 50	LT 50	LT 50
126	SILVER	23		18(78)	LT 8	9	LT 2	18
127	THALLIUM	23		0(0)	1- 50	LT 50	LT 50	LT 50

NOTES: 1) ALL UNITS IN UG/L UNLESS OTHERWISE NOTED
2) METALS AND CLASSICAL POLLUTANTS ARE NEVER REPORTED AS NOT DETECTED
3) POLLUTANTS NOT DETECTED ARE NOT LISTED
4) PP - PRIORITY POLLUTANT NUMBER
N-D - NOT DETECTED
LT - LESS THAN

TABLE VII-1
PERCENT OCCURENCES FOR PRIORITY POLLUTANTS 5/30/79
PLANT A SAMPLE POINT: INFLUENT

PP	PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES DETECTED (PERCENT)	NUMBER OF TIMES DETECTED ABOVE MIN.	AVERAGE	MEDIAN	MINIMUM	MAXIMUM
128	ZINC	23		23(100)	264	258	23	503
	BOD(MG-L)	27		27(100)	215	180	82	450
	COD(MG-L)	26		26(100)	431	435	180	630
	TOC(MG-L)	27		27(100)	205	240	39	340
	OIL & GREASE(MG-L)	78		78(100)	49	40	18	340
	TOTAL PHENOLS	83		82(99)	LT 129	48	LT 6	5200
	TOTAL SOLIDS(MG-L)	27		27(100)	739	970	670	1300
	TOTAL SUSP. SOLIDS(MG-L)	27		27(100)	175	130	77	560
	TOTAL VOLATILE SOLIDS(MG-L)	27		27(100)	252	260	130	540
	TOTAL VOL. SUS. SOLIDS(MG-L)	27		27(100)	113	89	56	300
	AMMONIA NITROGEN	27		27(100)	7230	6500	3600	18000
	ALUMINUM	23		23(100)	1460	1400	248	2420
	BARIUM	23		23(100)	129	131	66	203
	IRON	23		23(100)	2990	1770	404	26000
	MANGANESE	23		23(100)	104	107	56	154
	CALCIUM(MG-L)	23		23(100)	83	87	53	102
	MAGNESIUM(MG-L)	23		23(100)	27	29	17	33

NOTES: 1) ALL UNITS IN UG/L UNLESS OTHERWISE NOTED
2) METALS AND CLASSICAL POLLUTANTS ARE NEVER REPORTED AS NOT DETECTED
3) POLLUTANTS NOT DETECTED ARE NOT LISTED
4) PP - PRIORITY POLLUTANT NUMBER
N-D - NOT DETECTED
LT - LESS THAN

phthalate; tetrachloroethylene; toluene, and trichloroethylene) were reduced by a minimum of 50 percent. Only phenol was not effectively removed. Carbon tetrachloride and 1,1,2-trichloroethane were each measured at an average concentration of several micrograms per liter (µg/l) in the influent, and were not detected in any effluent samples, resulting in a computed 100 percent removal.

During the week of sampling, Plant B achieved moderate removals of BOD and TSS (74 percent and 80 percent, respectively). The influent values for these parameters (95 and 97 mg/l) were approximately half those of Plant A. Metals at Plant B occurred at relatively low levels. Antimony, arsenic, beryllium, selenium and thallium were not measured above their detection limit in either influent or effluent samples. Cadmium and silver were both reduced from several µg/l to below their detection limits. Cadmium, copper and zinc were reduced effectively, between 69 and 81 percent. Lead and nickel were removed less effectively. Organic priority pollutants at Plant B occurred at such low average concentrations that percent removal data were not meaningful.

Concentrations of Priority Pollutants in Sludge

The concentrations of conventional and priority pollutants in primary and secondary sludge and floatables for Plant A are also indicated on Table VII-3. Most of the metals occurred in high concentrations in both the primary and secondary sludge. Cadmium, copper, lead, nickel and zinc were each found in primary sludge at concentrations over 100 times greater than their concentration in the influent. Atimony, arsenic, and beryllium, which were never measured above their detection limit in the influent, were all measured in the primary sludge. Chromium and cyanide were found in the primary sludge at 30 to 50 times their influent concentration. Chromium had a higher than expected concentration in the secondary sludge.

TABLE VII-2
PERCENT OCCURENCES OF PRIORITY POLLUTANTS

PLANT B

SAMPLE POINT: INFLUENT

5/30/79

PP	PARAMETER	SAMPLES ANALYZED	TIMES DETECTED (PERCENT)	TIMES DETECTED ABOVE MIN.	AVERAGE	MEDIAN	MINIMUM	MAXIMUM
		----------NUMBER OF------------						
4	BENZENE	42	31(74)	4(10)	7- 14	LT 10	N-D	260
7	CHLOROBENZENE	42	2(5)	0(0)	0- 1	N-D	N-D	LT 10
10	1,2-DICHLOROETHANE	42	5(12)	1(2)	0- 1	N-D	N-D	13
11	1,1,1-TRICHLOROETHANE	42	10(24)	0(0)	1- 2	N-D	N-D	LT 10
13	1,1-DICHLOROETHANE	42	2(5)	0(0)	0- 1	N-D	N-D	LT 10
23	CHLOROFORM	42	40(95)	0(0)	1- 9	LT 10	N-D	LT 10
25	1,2-DICHLOROBENZENE	6	5(83)	0(0)	1- 8	LT 10	N-D	LT 10
26	1,3-DICHLOROBENZENE	6	1(17)	0(0)	0- 1	N-D	N-D	LT 10
27	1,4-DICHLOROBENZENE	6	1(17)	0(0)	0- 1	N-D	N-D	LT 10
29	1,1-DICHLOROETHYLENE	42	16(38)	0(0)	1- 3	N-D	N-D	LT 10
32	1,2-DICHLOROPROPANE	42	1(2)	0(0)	0- 1	N-D	N-D	LT 10
36	2,6-DINITROTOLUENE	6	1(17)	0(0)	0- 1	N-D	N-D	LT 10
38	ETHYLBENZENE	42	18(43)	0(0)	1- 4	N-D	N-D	LT 10
39	FLUORANTHENE	6	3(50)	0(0)	1- 5	LT 5	N-D	LT 10
44	METHYLENE CHLORIDE	42	39(93)	5(12)	6- 14	LT 10	N-D	180
48	DICHLOROBROMOMETHANE	42	4(10)	0(0)	0- 1	N-D	N-D	LT 10
51	CHLORODIBROMOMETHANE	42	3(7)	0(0)	0- 1	N-D	N-D	LT 10
54	ISOPHORONE	6	1(17)	0(0)	0- 1	N-D	N-D	LT 10
55	NAPHTHALENE	6	4(67)	0(0)	1- 6	LT 10	N-D	LT 10
64	PENTACHLOROPHENOL	6	1(17)	0(0)	0- 1	N-D	N-D	LT 10
65	PHENOL	6	4(67)	0(0)	1- 6	LT 10	N-D	LT 10
66	BIS(2-ETHYLHEXYL) PHTHALATE	6	6(100)	3(50)	8- 14	1	LT 10	19
67	BUTYL BENZYL PHTHALATE	6	6(100)	0(0)	1- 10	LT 10	LT 10	LT 10
68	DI-N-BUTYL PHTHALATE	6	5(83)	0(0)	1- 8	LT 10	N-D	LT 10
69	DI-N-OCTYL PHTHALATE	6	4(67)	0(0)	1- 6	LT 10	N-D	LT 10
70	DIETHYL PHTHALATE	6	5(83)	0(0)	1- 8	LT 10	N-D	LT 10
71	DIMETHYL PHTHALATE	6	3(50)	0(0)	1- 5	LT 5	N-D	LT 10
78	ANTHRACENE	6	3(50)	0(0)	1- 5	LT 5	N-D	LT 10
81	PHENANTHRENE	6	3(50)	0(0)	1- 5	LT 5	N-D	LT 10
84	PYRENE	6	3(50)	0(0)	1- 5	LT 5	N-D	LT 10
85	TETRACHLOROETHYLENE	42	41(98)	0(0)	1- 9	LT 10	N-D	LT 10
86	TOLUENE	42	32(76)	1(2)	1- 8	LT 10	N-D	37
87	TRICHLOROETHYLENE	42	14(33)	0(0)	1- 3	N-D	N-D	LT 10
114	ANTIMONY	7		0(0)	1- 50	LT 50	LT 50	LT 50
115	ARSENIC	7		0(0)	1- 50	LT 50	LT 50	LT 50
117	BERYLLIUM	7		0(0)	1- 2	LT 2	LT 2	LT 2
118	CADMIUM	7		6(86)	LT 4	4	LT 2	9
119	CHROMIUM	7		7(100)	71	67	12	131
120	COPPER	7		7(100)	54	55	39	72
121	CYANIDE	41		34(83)	77- 78	66	LT 10	240
122	LEAD	7		2(29)	16- 30	LT 20	LT 20	79
123	MERCURY	7		5(71)	0.0- 0.3	0.2	LT 0.2	0.4
124	NICKEL	7		7(100)	30	31	11	48
125	SELENIUM	7		0(0)	1- 50	LT 50	LT 50	LT 50
126	SILVER	7		2(29)	1- 2	LT 2	LT 2	6
127	THALLIUM	7		0(0)	1- 50	LT 50	LT 50	LT 50
128	ZINC	7		7(100)	278	302	111	439
	BOD(MG-L)	7		7(100)	95	96	73	130
	COD(MG-L)	7		7(100)	183	180	150	230
	TOC(MG-L)	7		7(100)	70	69	61	82
	OIL & GREASE(MG-L)	40		40(100)	24	26	5	48
	TOTAL PHENOLS	42		40(95)	LT 20	12	LT 1	160
	TOTAL SOLIDS(MG-L)	7		7(100)	619	610	510	750
	TOTAL SUSP. SOLIDS(MG-L)	7		7(100)	97	87	55	220
	TOTAL VOLATILE SOLIDS(MG-L)	7		7(100)	143	140	88	200
	TOTAL VOL. SUS. SOLIDS(MG-L)	7		7(100)	54	42	27	120
	AMMONIA NITROGEN	7		7(100)	11700	11000	9000	17000
	ALUMINUM	7		7(100)	537	452	262	1410
	BARIUM	7		7(100)	74	75	57	93
	IRON	7		7(100)	1640	1370	1100	3610
	MANGANESE	7		7(100)	280	271	255	334
	CALCIUM(MG-L)	7		7(100)	69	68	67	75
	MAGNESIUM(MG-L)	7		7(100)	15	14	14	16

NOTES: 1) ALL UNITS IN UG/L UNLESS OTHERWISE NOTED
2) METALS AND CLASSICAL POLLUTANTS ARE NEVER REPORTED AS NOT DETECTED
3) POLLUTANTS NOT DETECTED ARE NOT LISTED
4) PP - PRIORITY POLLUTANT NUMBER
N-D - NOT DETECTED
LT - LESS THAN

TABLE VII-3
PLANT A
DATA SUMMARY-WEEK 1 AVERAGE

05/30/79

DATE	PP	PARAMETER	INFLUENT	EFFLUENT PRE CL-	FINAL EFFLUENT	PERCENT REMOVAL	PRIMARY SLUDGE	SECONDARY SLUDGE	COMBINED SLUDGE	FLOTA-BLES
JULY 78	1	ACENAPHTHENE	0- 1	N-D	N-D		169	N-D	75	189
JULY 78	3	ACRYLONITRILE	N-D	N-D	N-D		N-D	3	NOT RUN	2
JULY 78	4	BENZENE	5- 13	L 1	0- 5		171	10	NOT RUN	42
JULY 78	6	CARBON TETRACHLORIDE	1- 2	N-D	N-D	100	11	6	NOT RUN	7
JULY 78	7	CHLOROBENZENE	0- 2	N-D	N-D		N-D	N-D	NOT RUN	N-D
JULY 78	8	1,2,4-TRICHLOROBENZENE	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	9	HEXACHLOROBENZENE	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	10	1,2-DICHLOROETHANE	N-D	N-D	N-D		N-D	N-D	NOT RUN	N-D
JULY 78	11	1,1,1-TRICHLOROETHANE	17- 20	L 10	0- 7	59-100	24	N-D	NOT RUN	2
JULY 78	13	1,1-DICHLOROETHANE	0- 2	N-D	N-D		11	N-D	NOT RUN	N-D
JULY 78	14	1,1,2-TRICHLOROETHANE	7	N-D	N-D	100	N-D	N-D	NOT RUN	N-D
JULY 78	21	2,4,6-TRICHLOROPHENOL	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	22	PARACHLOROMETA CRESOL	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	23	CHLOROFORM	49- 50	L 28	15- 21	57- 70	N-D	N-D	NOT RUN	N-D
JULY 78	24	2-CHLOROPHENOL	N-D	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	25	1,2-DICHLOROBENZENE	0- 4	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	26	1,3-DICHLOROBENZENE	0- 2	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	27	1,4-DICHLOROBENZENE	0- 4	N-D	0- 3		N-D	N-D	N-D	N-D
JULY 78	28	3,3'-DICHLOROBENZIDINE	N-D	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	29	1,1-DICHLOROETHYLENE	1- 8	L 5	0- 7		9	N-D	NOT RUN	N-D
JULY 78	30	1,2-TRANS-DICHLOROETHYLENE	0- 8	N-D	0- 2		23	N-D	NOT RUN	4
JULY 78	32	1,2-DICHLOROPROPANE	N-D	N-D	N-D		N-D	N-D	NOT RUN	N-D
JULY 78	34	2,4-DIMETHYLPHENOL	N-D	L 3	0- 1		N-D	N-D	N-D	N-D
JULY 78	38	ETHYLBENZENE	30- 36	N-D	0- 7	77- 99	276	L 4	NOT RUN	51
JULY 78	39	FLUORANTHENE	0- 3	N-D	0- 4		N-D	N-D	N-D	N-D
JULY 78	43	BIS(2-CHLOROETHYOXY) METHANE	0- 1	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	44	METHYLENE CHLORIDE	6- 14	L 10	1- 10	0- 91	222	249	NOT RUN	243
JULY 78	45	CHLOROMETHANE	N-D	N-D	N-D		N-D	N-D	NOT RUN	N-D
JULY 78	48	DICHLOROBROMOMETHANE	N-D	N-D	0- 2		57	56	NOT RUN	41
JULY 78	49	TRICHLOROFLUOROMETHANE	N-D	N-D	0- 1		N-D	N-D	NOT RUN	N-D
JULY 78	51	CHLORODIBROMOMETHANE	N-D	N-D	N-D		17	29	NOT RUN	25
JULY 78	52	HEXACHLOROBUTADIENE	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	55	NAPHTHALENE	1- 3	N-D	0- 4		195	4	L 23	421
JULY 78	64	PENTACHLOROPHENOL	0- 3	L 7	0- 1		93	112	15	230
JULY 78	65	PHENOL	13- 19	L 10	18- 23	0- 5	94	68	33	7
JULY 78	66	BIS(2-ETHYLHEXYL) PHTHALATE	32- 36	L 19	11- 16	50- 69	2230	42	1240	511
JULY 78	67	BUTYL BENZYL PHTHALATE	1- 4	N-D	0- 4		1	N-D	N-D	100
JULY 78	68	DI-N-BUTYL PHTHALATE	2- 9	L 3	0- 5		N-D	N-D	N-D	5
JULY 78	69	DI-N-OCTYL PHTHALATE	N-D	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	70	DIETHYL PHTHALATE	0- 6	N-D	0- 3		N-D	N-D	N-D	N-D
JULY 78	71	DIMETHYL PHTHALATE	0- 4	N-D	0- 1		N-D	N-D	N-D	N-D
JULY 78	72	1,2-BENZANTHRACENE	0- 1	N-D	0- 1		479	N-D	250	186
JULY 78	74	3,4-BENZOFLUORANTHENE	N-D	N-D	N-D		675	N-D	299	137
JULY 78	76	CHRYSENE	0- 1	N-D	0- 1		479	N-D	250	186
JULY 78	77	ACENAPHTHYLENE	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	78	ANTHRACENE	0- 7	N-D	0- 4		1570	4	842	1120
JULY 78	79	1,12-BENZOPERYLENE	N-D	N-D	N-D		N-D	N-D	N-D	N-D
JULY 78	80	FLUORENE	0- 3	N-D	0- 1		313	N-D	133	2
JULY 78	81	PHENANTHRENE	0- 7	N-D	0- 4		1570	4	842	1120
JULY 78	82	1,2:5,6-DIBENZANTHRACENE	N-D	N-D	0- 1		N-D	10	N-D	N-D
JULY 78	83	INDENO(1,2,3-C,D) PYRENE	N-D	N-D	0- 1		N-D	8	N-D	N-D
JULY 78	84	PYRENE	0- 3	N-D	0- 6		757	N-D	349	192
JULY 78	85	TETRACHLOROETHYLENE	53- 57	L 10	1- 9	83- 98	293	L 7	NOT RUN	72
JULY 78	86	TOLUENE	18- 23	L 10	0- 9	51-100	284	2	NOT RUN	79
JULY 78	87	TRICHLOROETHYLENE	24- 29	L 9	0- 9	65-100	284	L 1	NOT RUN	23
JULY 78	114	ANTIMONY	0- 50	L 50	0- 50		146	L 22	56	L 11
JULY 78	115	ARSENIC	0- 50	L 50	0- 50		1260	63	176	L 29
JULY 78	117	BERYLLIUM	0- 2	L 2	0- 2		37	10	12	L N-D
JULY 78	118	CADMIUM	12	L 4	4- 5	60- 65	1220	344	599	32
JULY 78	119	CHROMIUM	443	42	46	90	14600	19100	17900	4440
JULY 78	120	COPPER	194	13	27	86	77400	3970	24200	1690
JULY 78	121	CYANIDE	13- 18	NOT RUN	3- 11	15- 93	626	L 75	NOT RUN	L 36
JULY 78	122	LEAD	48- 56	L 20	0- 20	58-100	46900	1590	11000	L 113
JULY 78	123	MERCURY	0.3	L 0.4	0.4	24	L 3.1	L 2.6	L 2.7	L 2.1
JULY 78	124	NICKEL	98	50	40	59	13300	3340	3190	411
JULY 78	125	SELENIUM	0- 50	L 50	0- 50		L 10	L 23	L 12	L 10
JULY 78	126	SILVER	8	L 2	0- 2	74-100	25	182	82	L 20
JULY 78	127	THALLIUM	0- 50	L 50	0- 50		2	L 1	L 1	L 2
JULY 78	128	ZINC	252	42	90	64	153000	12800	47900	2450
JULY 78		BOD(MG-L)	201	22	13	94	20200	6030	6670	1900
JULY 78		COD(MG-L)	416	69	68	84	57500	6720	18400	7650
JULY 78		TOC(MG-L)	255	55	65	75	23500	2720	8180	2250
JULY 78		OIL & GREASE(MG-L)	53	NOT RUN	4- 6	89- 92	9070	L 482	NOT RUN	19300
JULY 78		TOTAL PHENOLS	178	NOT RUN	13- 14	92- 93	672	L 37	NOT RUN	82
JULY 78		TOTAL SOLIDS(MG-L)	931	835	834	10	56700	6030	19300	11100
JULY 78		TOTAL SUSP. SOLIDS(MG-L)	140	10	20	86	46700	6300	17500	3260
JULY 78		TOTAL VOLATILE SOLIDS(MG-L)	232	130	262		26800	3290	9670	9170
JULY 78		TOTAL VOL. SUS. SOLIDS(MG-L)	105	8	14	87	23300	4200	7800	2960
JULY 78		AMMONIA NITROGEN	6170	5450	4920	20	58500	9650	22800	6270
JULY 78		ALUMINUM	1360	128	203	85	NOT RUN	NOT RUN	NOT RUN	NOT RUN
JULY 78		BARIUM	127	42	50	61	NOT RUN	NOT RUN	NOT RUN	NOT RUN
JULY 78		IRON	3210	256	392	88	NOT RUN	NOT RUN	NOT RUN	NOT RUN
JULY 78		MANGANESE	100	120	111		NOT RUN	NOT RUN	NOT RUN	NOT RUN
JULY 78		CALCIUM(MG-L)	82	86	79	3	NOT RUN	NOT RUN	NOT RUN	NOT RUN
JULY 78		MAGNESIUM(MG-L)	26	30	27		NOT RUN	NOT RUN	NOT RUN	NOT RUN

ALL UNITS UG/L UNLESS OTHERWISE NOTED. PP- PRIORITY POLLUTANT NUMBER. N-D NOT DETECTED; L-LESS THAN
PRIORITY POLLUTANTS NOT LISTED WERE NOT DETECTED IN ANY SAMPLES
NOT RUN INDICATES THAT NO SAMPLE WAS COLLECTED OR ANALYTICAL RESULTS HAVE NOT BEEEN RECEIVED

TABLE VII-4
PLANT B
DATA SUMMARY

05/30/79

DATE	PP	PARAMETER	INFLUENT	EFFLUENT PRE CL-	FINAL EFFLUENT	PERCENT REMOVAL	SECONDARY SLUDGE	COMBINED SLUDGE	TAF WATER	DAF BLANKET
AUG. 78	3	ACRYLONITRILE	N-D	N-D	N-D	N-D	N-D	41	N-D	N-D
AUG. 78	4	BENZENE	7- 14	L 1	L 4	44- 84	L 5	33	N-D	10
AUG. 78	10	1,2-DICHLOROETHANE	0- 1	L 2	L 2		N-D	N-D	N-D	N-D
AUG. 78	11	1,1,1-TRICHLOROETHANE	0- 2	L 1	L 0.5		N-D	N-D	N-D	N-D
AUG. 78	23	CHLOROFORM	0- 10	L 10	L 10	0- 91	N-D	N-D	75	N-D
AUG. 78	25	1,2-DICHLOROBENZENE	0- 8	L 1	L 4		NOT RUN	N-D	L 10	NOT RUN
AUG. 78	26	1,3-DICHLOROBENZENE	0- 7	L 3	L 5		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	27	1,4-DICHLOROBENZENE	0- 2	N-D	N-D		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	28	3,3'-DICHLOROBENZIDINE	N-D	N-D	L 1		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	29	1,1-DICHLOROETHYLENE	0- 4	L 2	L 3		N-D	N-D	N-D	N-D
AUG. 78	30	1,2-TRANS-DICHLOROETHYLENE	N-D	L 0.5	N-D	N-D	N-D	N-D	N-D	N-D
AUG. 78	36	2,6-DINITROTOLUENE	0- 2	N-D	N-D		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	38	ETHYLBENZENE	0- 4	L 0.5	L 1		5	2	N-D	10
AUG. 78	39	FLUORANTHENE	0- 5	N-D	N-D		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	44	METHYLENE CHLORIDE	0- 14	L 9	L 10		180	247	30	250
AUG. 78	47	BROMOFORM	N-D	N-D	N-D	N-D	N-D	N-D	L 10	N-D
AUG. 78	48	DICHLOROBROMOMETHANE	0- 1	L 2	L 3		35	74	N-D	35
AUG. 78	51	CHLORODIBROMOMETHANE	0- 1	L 2	L 3		N-D	6	20	N-D
AUG. 78	54	ISOPHORONE	0- 2	N-D	N-D		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	55	NAPHTHALENE	0- [illegible]	L 1	L 4		NOT RUN	91	N-D	NOT RUN
AUG. 78	57	2-NITROPHENOL	N-D	L 8	L 4		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	58	4-NITROPHENOL	N-D	L 34	L 14		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	64	PENTACHLOROPHENOL	0- 2	L 4	L 1		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	65	PHENOL	0- 7	L 6	L 9		NOT RUN	4	L 10	NOT RUN
AUG. 78	66	BIS(2-ETHYLHEXYL) PHTHALATE	9- 14	L 11	L 9		NOT RUN	1490	L 10	NOT RUN
AUG. 78	67	BUTYL BENZYL PHTHALATE	0- 10	L 7	L 5		NOT RUN	N-D	L 10	NOT RUN
AUG. 78	68	DI-N-BUTYL PHTHALATE	0- 8	L 6	L 6		NOT RUN	N-D	L 10	NOT RUN
AUG. 78	69	DI-N-OCTYL PHTHALATE	0- [illegible]	L 1	L 1		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	70	DIETHYL PHTHALATE	0- 8	L 3	L 4		NOT RUN	N-D	L 10	NOT RUN
AUG. 78	71	DIMETHYL PHTHALATE	0- 5	L 1	L 3		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	72	1,2-BENZANTHRACENE	N-D	N-D	L 1		NOT RUN	8	N-D	NOT RUN
AUG. 78	74	3,4-BENZOFLUORANTHENE	N-D	N-D	N-D		NOT RUN	43	N-D	NOT RUN
AUG. 78	76	CHRYSENE	N-D	N-D	L 1		NOT RUN	8	N-D	NOT RUN
AUG. 78	77	ACENAPHTHYLENE	N-D	L 1	L 3		NOT RUN	N-D	N-D	NOT RUN
AUG. 78	78	ANTHRACENE	0- 5	N-D	N-D		NOT RUN	91	N-D	NOT RUN
AUG. 78	81	PHENANTHRENE	0- 5	N-D	N-D		NOT RUN	91	N-D	NOT RUN
AUG. 78	84	PYRENE	0- 5	N-D	N-D		NOT RUN	45	N-D	NOT RUN
AUG. 78	85	TETRACHLOROETHYLENE	0- 10	L 5	L 6		N-D	61	N-D	15
AUG. 78	86	TOLUENE	1- 8	L 5	L 7		25	336	L 10	230
AUG. 78	87	TRICHLOROETHYLENE	0- 3	L 0.5	L 0.5		N-D	N-D	N-D	N-D
AUG. 78	114	ANTIMONY	0- 50	L 50	L 50		NOT RUN	39	L 50	NOT RUN
AUG. 78	115	ARSENIC	0- 50	L 50	L 50		NOT RUN	149	L 50	NOT RUN
AUG. 78	117	BERYLLIUM	L 2.0	L 2.0	L 2.0		-888.0	L 12.0	L 2.0	-888.0
AUG. 78	118	CADMIUM	4- 5	L 2	L 2	55-100	NOT RUN	305	L 2	NOT RUN
AUG. 78	119	CHROMIUM	71	26	22	69	NOT RUN	8110	L 5	NOT RUN
AUG. 78	120	COPPER	54	11	10	81	NOT RUN	10700	6	NOT RUN
AUG. 78	121	CYANIDE	77- 78	NOT RUN	L 141		337	1690	L 10	2870
AUG. 78	122	LEAD	16- 30	L 23	L 20		NOT RUN	7390	L 20	NOT RUN
AUG. 78	123	MERCURY	L 0.3	L 0.2	L 0.2	5-100	NOT RUN	L 5.1	L 0.2	NOT RUN
AUG. 78	124	NICKEL	30	21	20	33	NOT RUN	3100	L 10	NOT RUN
AUG. 78	125	SELENIUM	0- 50	L 50	L 50		NOT RUN	L 28	L 50	NOT RUN
AUG. 78	126	SILVER	1- 3	L 7	L 2	0- 84	NOT RUN	L 79	L 2	NOT RUN
AUG. 78	127	THALLIUM	0- 50	L 50	L 50		NOT RUN	L 2	L 50	NOT RUN
AUG. 78	128	ZINC	278	83	52	81	NOT RUN	L 26700	7	NOT RUN
AUG. 78		BOD(MG-L)	85	20	25	74	NOT RUN	8460	L 10	NOT RUN
AUG. 78		COD(MG-L)	183	52	57	69	NOT RUN	32400	L 1	NOT RUN
AUG. 78		TOC(MG-L)	70	29	33	53	NOT RUN	11900	22	NOT RUN
AUG. 78		OIL & GREASE(MG-L)	24	NOT RUN	L 8	66- 67	L 250	3510	7	11000
AUG. 78		TOTAL PHENOLS	20	NOT RUN	L 4	81- 84	8	464	6	2800
AUG. 78		TOTAL SOLIDS(MG-L)	619	496	564	9	NOT RUN	25600	300	NOT RUN
AUG. 78		TOTAL SUSP. SOLIDS(MG-L)	97	12	19	80	NOT RUN	21700	3	NOT RUN
AUG. 78		TOTAL VOLATILE SOLIDS(MG-L)	143	129	136	5	NOT RUN	14300	85	NOT RUN
AUG. 78		TOTAL VOL. SUS. SOLIDS(MG-L)	54	7	12	78	NOT RUN	12100	2	NOT RUN
AUG. 78		AMMONIA NITROGEN	11700	1830	3300	72	NOT RUN	76900	74000	NOT RUN
AUG. 78		ALUMINUM	537	74	L 54	90- 91	NOT RUN	NOT RUN	108	NOT RUN
AUG. 78		BARIUM	74	26	25	66	NOT RUN	NOT RUN	40	NOT RUN
AUG. 78		IRON	1640	198	188	89	NOT RUN	NOT RUN	108	NOT RUN
AUG. 78		MANGANESE	280	194	186	34	NOT RUN	NOT RUN	5	NOT RUN
AUG. 78		CALCIUM(MG-L)	67	64	65	6	NOT RUN	NOT RUN	40	NOT RUN
AUG. 78		MAGNESIUM(MG-L)	15	14	14	7	NOT RUN	NOT RUN	9	NOT RUN

ALL UNITS UG/L UNLESS OTHERWISE NOTED: PP-PRIORITY POLLUTANT NUMBER: N-D NOT DETECTED: L- LESS THAN
NOT RUN INDICATES SAMPLES WERE NOT COLLECTED OR DATA HAS NOT BEEN RECEIVED
PRIORITY POLLUTANTS NOT LISTED WERE NOT DETECTED IN ANY SAMPLES

41<

Several organic priority pollutants that were detected at very low concentrations in the influent accumulated in the primary or secondary sludge. Among them were acenaphthene (0 to 1 µg/l average in the influent and 169 µg/l in the primary sludge); 1,2-benzathracene (less than 1 and 479); 3,4-benzofluoranthene (not detected and 675); fluorene (less than 3 and 313); and pyrene (less than 3 and 757).

Data from Plant B indicated the same general trends (Table VII-4). Chromium, copper, lead, nickel and zinc were found in the combined sludge at approximately 100 times their concentration in the influent. Arsenic, cadmium, cyanide, mercury and silver also accumulated in the sludge, but occurred at overall lower levels. Antimony, beryllium, selenium and thallium, which were never measured above their detection limits in the influent, were all found at concentrations below 50 µg/l in the sludge. Consequently, no conclusions regarding build-up of these metals in the sludge can be developed.

Several organic priority pollutants present at very low levels in influent also were concentrated in the sludge. They included acrylonitrile (not detected in the influent and 41 µg/l in the combined sludge); dichlorobromomethane (0 to 1 and 74); and 3,4 benzofluoranthene (not detected and 43).

Mass Balances

Additional information correlating the influent and sludge concentrations of priority pollutants is indicated in Tables VII-5 and VII-6. These tables show the approximate pounds of each pollutant present in the influent, effluent and sludge from Plants A and B, respectively. For Plant A there was moderately good agreement on the pounds entering and leaving the POTW for most conventional parameters and metallic priority pollutants. However, copper, lead and zinc balanced poorly. Most metals did show a tendency to accumulate in the sludge. The pounds of cadmium, chromium, copper, lead, nickel, silver and zinc in the primary and secondary sludge were each 2 to 15 times the amount calculated to be in the final effluent. An average of less than one pound per day of antimony, beryllium, selenium and thallium was measured in the sludge of Plant A. Arsenic was detected in Plant A's sludges at over four pounds per day despite the fact that it had never been measured above the detection limit in the influent.

For many organic priority pollutants, the mass balance data support the removal mechanisms of either oxidation, biodegradation or air stripping. The most striking example is chloroform, where none was detected in any sludge samples, despite an overall reduction from 37 to 38 pounds per day in the influent to less than 16 pounds per day in the effluent. Similar tendencies were exhibited for other refractory but volatile pollutants, such as benzene; 1,1,1-trichloroethylene; ethyl benzene; tetrachloroethylene; toluene; and trichloroethylene. Organic compounds which seemed to build up in the sludge include acenaphthene; dichlorobromomethane; chlorodibromomethane; 1,2-benzanthracene; 3,4-benzofluoranthene; anthracene; and fluorene.

Overall, Plant B had lower concentrations of priority pollutants than Plant A and the accumulation of materials in the sludge was less pronounced. Of the metals, only chromium, copper, lead and zinc accumulated to some degree in the sludge, and all were present in greater quantity in the combined sludge than in the final effluent. There were insufficient data upon which to draw many conclusions regarding organic priority pollutant removal mechanisms or accumulation in sludges at Plant B. No organic priority pollutants were present at an average of over one pound per day in Plant B's influent, or combined sludge.

Mechanisms for Toxic Pollutant Removal

Removal of toxic pollutants in a POTW can occur as a result of various physical, chemical or biological processes that take place within the treatment system. The exact combination of these phenomena affecting any particular priority pollutant depends largely on the nature of the pollutant itself.

TABLE VII-5
PLANT A
MASS BALANCE
WEEKLY SUMMARY (LB/DAY)

5-30-79

PP	PARAMETER NAME	INFLUENT	TOTAL OUT	FINAL EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
1	ACENAPHTHENE	0 - 0.72	0.46 - 0.46	N-D	0.46	N-D
3	ACRYLONITRILE	N-D	0.035- 0.035	N-D	N-D	0.035
4	BENZENE	3.6 - 10	0.58 - 4.1 L	3.5	0.46	0.12
6	CARBON TETRACHLORIDE	0.72 - 1.3	0.099- 0.099	N-D	0.029	0.07
7	CHLOROBENZENE	0 - 1.1	N-D	N-D	N-D	N-D
8	1,2,4-TRICHLOROBENZENE	0 - 0.36	N-D	N-D	N-D	N-D
9	HEXACHLOROBENZENE	0 - 0.36	N-D	N-D	N-D	N-D
10	1,2-DICHLOROETHANE	0 - 0.19	N-D	N-D	N-D	N-D
11	1,1,1-TRICHLOROETHANE	13 - 15	0.064- 5.3 L	5.2	0.064	N-D
13	1,1-DICHLOROETHANE	0 - 1.5	0.029- 0.029	N-D	0.029	N-D
14	1,1,2-TRICHLOROETHANE	5 - 5.4	N-D	N-D	N-D	N-D
21	2,4,6-TRICHLOROPHENOL	0 - 0.36	N-D	N-D	N-D	N-D
22	PARACHLOROMETA CRESOL	0 - 0.36	N-D	N-D	N-D	N-D
23	CHLOROFORM	37 - 38	12 - 16 L	16	N-D	N-D
24	2-CHLOROPHENOL	N-D	0 - 1.1 L	1.1	N-D	N-D
25	1,2-DICHLOROBENZENE	0 - 3.3	0 - 1.1 L	1.1	N-D	N-D
26	1,3-DICHLOROBENZENE	0 - 1.8	0 - 1.1 L	1.1	N-D	N-D
27	1,4-DICHLOROBENZENE	0 - 2.9	0 - 2.1 L	2.1	N-D	N-D
28	3,3'-DICHLOROBENZIDINE	N-D	0 - 1.1 L	1.1	N-D	N-D
29	1,1-DICHLOROETHYLENE	0.44 - 6	0.023- 5.4 L	5.4	0.023	N-D
30	1,2-TRANS-DICHLOROETHYLENE	0.37 - 5.7	0.062- 1.4 L	1.3	0.062	N-D
32	1,2-DICHLOROPROPANE	0 - 0.37	N-D	N-D	N-D	N-D
34	2,4-DIMETHYLPHENOL	N-D	0 - 1.1 L	1.1	N-D	N-D
38	ETHYLBENZENE	23 - 28	1 - 5.9 L	5.1	0.740 L	0.044
39	FLUORANTHENE	0 - 2.2	0 - 3.2 L	3.2	N-D	N-D
43	BIS(2-CHLOROETHYOXY) METHANE	0 - 0.72	N-D	N-D	N-D	N-D
44	METHYLENE CHLORIDE	4.3 - 10	4.6 - 11 L	7.8	0.6	3
45	CHLOROMETHANE	0 - 0.37	N-D	N-D	N-D	N-D
48	DICHLOROBROMOMETHANE	0 - 0.19	0.84 - 2.5 L	1.7	0.15	0.68
49	TRICHLOROFLUOROMETHANE	0 - 0.19	0 - 0.37 L	0.37	N-D	N-D
51	CHLORODIBROMOMETHANE	N-D	0.4 - 0.4	N-D	0.046	0.36
52	HEXACHLOROBUTADIENE	0 - 0.36	N-D	N-D	N-D	N-D
55	NAPHTHALENE	0.47 - 5.9	0.58 - 3.8 L	3.2	0.53	0.049
64	PENTACHLOROPHENOL	0 - 2.2	1.6 - 2.7 L	1.1	0.25	1.4
65	PHENOL	9.7 - 15	15 - 19 L	17	0.25	0.83
66	BIS(2-ETHYLHEXYL) PHTHALATE	24 - 27	15 - 18 L	12	6	0.51
67	BUTYL BENZYL PHTHALATE	0.43 - 3	0.001- 3.2 L	3.2	0.001	N-D
68	DI-N-BUTYL PHTHALATE	1.6 - 7	0 - 4.3 L	4.3	N-D	N-D
69	DI-N-OCTYL PHTHALATE	0 - 0.36	0 - 1.1 L	1.1	N-D	N-D
70	DIETHYL PHTHALATE	0 - 4.7	0 - 2.1 L	2.1	N-D	N-D
71	DIMETHYL PHTHALATE	0 - 2.9	0 - 1.1 L	1.1	N-D	N-D
72	1,2-BENZANTHRACENE	0 - 0.72	1.3 - 2.4 L	1.1	1.2	N-D
74	3,4-BENZOFLUORANTHENE	N-D	1.8 - 1.8	N-D	1.8	0.005
76	CHRYSENE	0 - 0.72	1.3 - 2.4 L	1.1	1.3	N-D
77	ACENAPHTHYLENE	0 - 0.36	N-D	N-D	N-D	N-D
78	ANTHRACENE	0 - 5.4	4.3 - 7.5 L	3.2	4.2	0.054
79	1,12-BENZOPERYLENE	0 - 0.36	N-D	N-D	N-D	N-D
80	FLUORENE	0 - 2.2	0.84 - 1.9 L	1.1	0.84	N-D
81	PHENANTHRENE	0 - 5.4	4.3 - 7.5 L	3.2	4.2	0.054
82	1,2:5,6-DIBENZANTHRACENE	0 - 0.36	0.12 - 1.2 L	1.1	N-D	0.12
83	INDENO(1,2,3-C,D) PYRENE	0 - 0.36	0.098- 1.2 L	1.1	N-D	0.098
84	PYRENE	0 - 2.5	2 - 6.3 L	4.3	2	N-D
85	TETRACHLOROETHYLENE	40 - 43	1.8 - 7.5 L	6.7	0.790 L	0.087
86	TOLUENE	14 - 17	0.79 - 7.3 L	6.5	0.77	0.026
87	TRICHLOROETHYLENE	18 - 22	0.78 - 7.1 L	6.3	0.770 L	0.009
114	ANTIMONY	0 - 38	0.67 - 38 L	37	0.390 L	0.27
115	ARSENIC	0 - 38	4.2 - 41 L	37	3.4	0.77
117	BERYLLIUM	0 - 1.5	0.22 - 1.7 L	1.5	0.1	0.12
118	CADMIUM	8.9 - 9.1	11 - 11 L	3.6	3.3	4.2
119	CHROMIUM	337 - 337	296 - 295	34	39	221
120	COPPER	148 - 148	340 - 339	20	209	110
121	CYANIDE	9.5 - 14	4.9 - 11 L	8	1.700 L	0.91
122	LEAD	37 - 43	146 - 161 L	15	126	20
123	MERCURY	0.21 - 0.26	0.24 - 0.34 L	0.300 L	0.008 L	0.031
124	NICKEL	74 - 75	108 - 107	30	36	41
125	SELENIUM	0 - 38	0.3 - 38 L	37 L	0.028 L	0.28
126	SILVER	5.8 - 6.3	2.3 - 3.8 L	1.5	0.068	2.2
127	THALLIUM	0 - 38	0.022- 37 L	37	0.006 L	0.016

NOTES: L - LESS THAN

AVERAGE DAILY FLOWS (MGD): INFLUENT - 91.25
PRIMARY SLUDGE - 0.324
SECONDARY SLUDGE - 1.47

TABLE VII-5
PLANT A
MASS BALANCE
WEEKLY SUMMARY (LB/DAY)

5-30-7?

PP	PARAMETER NAME	INFLUENT	TOTAL OUT	FINAL EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
128	ZINC	192 - 192	638 - 637	67	413	157
	BOD(MG-L)	153000	138000	9940	54400	73900
	COD(MG-L)	316000	288000	50700	155000	82200
	TOC(MG-L)	193000	145000	48600	63400	33300
	OIL & GREASE(MG-L)	40100	34800	L 4450	24500	L 5910
	TOTAL PHENOLS	135	12	L 10	1.8	L 0.5
	TOTAL SOLIDS(MG-L)	707000	848000	621000	153000	73800
	TOTAL SUSP. SOLIDS(MG-L)	107000	218000	14800	126000	77100
	TOTAL VOLATILE SOLIDS(MG-L)	176000	308000	195000	72400	40300
	TOTAL VOL. SUS. SOLIDS(MG-L)	79700	125000	10300	63000	51400
	AMMONIA NITROGEN	4690	3930	3660	158	106
	ALUMINUM	1030000	151000	151000	N-D	N-D
	BARIUM	96600	36900	36900	N-D	N-D
	IRON	2440000	292000	292000	N-D	N-D
	MANGANESE	76200	82400	82400	N-D	N-D
	CALCIUM(MG-L)	62400	59100	59100	N-D	N-D
	MAGNESIUM(MG-L)	20100	19700	19700	N-D	N-D

NOTES: L - LESS THAN.
AVERAGE DAILY FLOWS (MGD): INFLUENT - 91.25
PRIMARY SLUDGE - 0.324
SECONDARY SLUDGE - 1.47

Physical removal mechanisms fall into three broad categories: removal as a solid with other suspended solids, adsorption onto suspended solids with subsequent removal, and atmospheric stripping. Removal of toxic pollutants with suspended solids in primary sludge is most prevalent for the heavy metals. Combination of the heavy metals with alkalinity or sulfide will produce insoluble species that settle out of raw sewage simultaneously with other wastewater solids.

Adsorption onto solid surfaces provides an additional removal mechanism for some organic priority pollutants. If an organic material is insoluble in water, slightly soluble or hydrophobic, the organic pollutant may preferentially adsorb on solid surfaces. In raw sewage, both suspended solids and floatables (greases) may be available for sorption. Therefore, when scum or primary sludge is removed, organic priority pollutants, which may be concentrated in these materials, may also be removed.

A significant proportion of the organic priority pollutants are relatively volatile. It has been postulated that during aeration some of these materials may be air stripped and subsequently released to the atmosphere. This phenomena might account for some observed removals of biologically refractory volatile organics, especially aromatic species, in activated sludge plants.

Chemical removal of toxic pollutants generally is applicable to organic materials which may come in contact with strong oxidants in the POTW. Most commonly, chlorine used for disinfection or odor control reacts with organic pollutants. At times, the organic species are simply chlorinated, sometimes creating toxic materials. However, removal may occur when the oxidation of the organic material goes to completion, destroying the toxic pollutant and forming carbon dioxide and water. Chlorine is not the only oxidant used within a POTW which could destroy organic pollutants. Hydrogen peroxide, which is sometimes used to control filamentous bulking, or ozone, which is gaining acceptance as a disinfectant, can also provide beneficial oxidation and removal of organic pollutants. Oxygen from aeration processes may also contribute to the oxidation of some materials.

Under the proper conditions, organic toxic pollutants may be biologically removed from sewage by acting as substrate for organisms in the treatment plant's biomass. Aliphatic compounds are generally more amenable to breakdown in biological systems than aromatic compounds, straight chain aliphatics being most easily degraded. In order for an organic pollutant to compete as a food source with normal organic constituents in sewage (carbohydrates, proteins, fatty acids, etc.) certain conditions should be maintained, such as acclimation to the possible toxic effects of the pollutant. If these conditions can be met, significant removal by biodegradation can occur.

TABLE VII-6

PLANT B 5-30-79

MASS BALANCE
WEEKLY SUMMARY (LB/DAY)

PP	PARAMETER NAME	INFLUENT		TOTAL OUT			FINAL EFFLUENT		COMBINED SLUDGE
3	ACRYLONITRILE		N-D	0.011-	0.011		N-D		0.011
4	BENZENE	0.480-	0.910	0.160-	0.280	L	0.270		0.008
7	CHLOROBENZENE	0 -	0.032		N-D		N-D		N-D
10	1,2-DICHLOROETHANE	0.021-	0.085	0 -	0.098	L	0.098		N-D
11	1,1,1-TRICHLOROETHANE	0 -	0.160	0 -	0.033	L	0.033		N-D
13	1,1-DICHLOROETHANE	0 -	0.032		N-D		N-D		N-D
23	CHLOROFORM	0 -	0.640	0.056-	0.680	L	0.680		N-D
25	1,2-DICHLOROBENZENE	0 -	0.560	0 -	0.250	L	0.250		N-D
26	1,3-DICHLOROBENZENE	0 -	0.110	0 -	0.340	L	0.340		N-D
27	1,4-DICHLOROBENZENE	0 -	0.110		N-D		N-D		N-D
28	3,3'-DICHLOROBENZIDINE		N-D	0 -	0.084	L	0.084		N-D
29	1,1-DICHLOROETHYLENE	0 -	0.260	0 -	0.180	L	0.180		N-D
32	1,2-DICHLOROPROPANE	0 -	0.016		N-D		N-D		N-D
36	2,6-DINITROTOLUENE	0 -	0.110		N-D		N-D		N-D
38	ETHYLBENZENE	0 -	0.290	0.001-	0.050	L	0.049		0.001
39	FLUORANTHENE	0 -	0.340		N-D		N-D		N-D
44	METHYLENE CHLORIDE	0.420-	0.960	0.064-	0.700	L	0.640		0.064
48	DICHLOROBROMOMETHANE	0 -	0.064	0.019-	0.230	L	0.210		0.019
51	CHLORODIBROMOMETHANE	0 -	0.048	0.002-	0.180	L	0.180		0.002
54	ISOPHORONE	0 -	0.110		N-D		N-D		N-D
55	NAPHTHALENE	0 -	0.450	0.023-	0.280	L	0.250		0.023
57	2-NITROPHENOL		N-D	0 -	0.250	L	0.250		N-D
58	4-NITROPHENOL		N-D	0.840-	0.920	L	0.920		N-D
64	PENTACHLOROPHENOL	0 -	0.110	0 -	0.084	L	0.084		N-D
65	PHENOL	0 -	0.450	0.130-	0.720	L	0.590		0.130
66	BIS(2-ETHYLHEXYL) PHTHALATE	0.570-	0.910	0.380-	0.970	L	0.590		0.380
67	BUTYL BENZYL PHTHALATE	0 -	0.670	0 -	0.340	L	0.340		N-D
68	DI-N-BUTYL PHTHALATE	0 -	0.560	0 -	0.420	L	0.420		N-D
69	DI-N-OCTYL PHTHALATE	0 -	0.450	0 -	0.084	L	0.084		N-D
70	DIETHYL PHTHALATE	0 -	0.560	0 -	0.250	L	0.250		N-D
71	DIMETHYL PHTHALATE	0 -	0.340	0 -	0.170	L	0.170		N-D
72	1,2-BENZANTHRACENE		N-D	0.002-	0.086	L	0.084		0.002
76	CHRYSENE		N-D	0.002-	0.086	L	0.084		0.002
77	ACENAPHTHYLENE		N-D	0 -	0.170	L	0.170		N-D
78	ANTHRACENE	0 -	0.340	0.023-	0.023		N-D		0.023
81	PHENANTHRENE	0 -	0.340	0.023-	0.023		N-D		0.023
84	PYRENE	0 -	0.340	0.012-	0.012		N-D		0.012
85	TETRACHLOROETHYLENE	0 -	0.660	0.016-	0.440	L	0.430		0.016
86	TOLUENE	0.059-	0.560	0.087-	0.550	L	0.460		0.087
87	TRICHLOROETHYLENE	0 -	0.220	0 -	0.016	L	0.016		N-D
114	ANTIMONY	0 -	3.400	0.010-	3.400	L	3.400		0.010
115	ARSENIC	0 -	3.400	0.039-	3.400	L	3.400		0.039
117	BERYLLIUM	0 -	0.130	0.003-	0.140	L	0.130	L	0.003
118	CADMIUM	0.290-	0.310	0.079-	0.210	L	0.130		0.079
119	CHROMIUM	4.800-	4.800	3.600-	3.600		1.500		2.100
120	COPPER	3.600-	3.600	3.500-	3.500		0.700		2.800
121	CYANIDE	5.200-	5.300	9.900-	9.900	L	9.500		0.440
122	LEAD	1.100-	2.000	1.900-	3.200	L	1.300		1.900
123	MERCURY	0.014-	0.018	0.001-	0.015	L	0.013	L	0.001
124	NICKEL	2.000-	2.000	2.100-	2.100		1.300		0.800
125	SELENIUM	0 -	3.400	0.007-	3.400	L	3.400	L	0.007
126	SILVER	0.087-	0.180	0.049-	0.160	L	0.140	L	0.020
127	THALLIUM	0 -	3.400	0 -	3.400	L	3.400	L	N-D
128	ZINC	19.000-	19.000	10.000-	10.000		3.500	L	6.900
	BOD(MG-L)	6370		3840			1650		2180
	COD(MG-L)	12300		12200			3840		8370
	TOC(MG-L)	4710		5300			2220		3080
	OIL & GREASE(MG-L)	1640		1460		L	549		907
	TOTAL PHENOLS	1.3		0.4		L	0.3		0.1
	TOTAL SOLIDS(MG-L)	41700		44400			37800		6600
	TOTAL SUSP. SOLIDS(MG-L)	6550		6910			1300		5610
	TOTAL VOLATILE SOLIDS(MG-L)	9610		12800			9110		3690
	TOTAL VOL. SUS. SOLIDS(MG-L)	3660		3900			780		3120
	AMMONIA NITROGEN	787		242			222		20

AVEAGE DAILY FLOWS (MGD): INFLUENT - 8.09
COMBINED SLUDGE - 0.031

A sometimes overlooked mechanism for the removal of inorganic priority pollutants via biological processes is the uptake of trace quantities of these pollutants as micronutrients. These materials may find their way into the biomass as a result of being complexed and incapsulated in a material that is consumed by cells.

In summary, in terms of organic priority pollutant removal, the preliminary findings presented herein indicate that aside from standard physical and biological removal mechanisms, atmospheric stripping of refractory volatile organics appears to be a significant phenomenon. Aromatic volatiles, which are resistant to biodegradation, were removed from the treatment system, but not concentrated in the sludge. It appears, therefore, that these materials were air stripped.

Polynuclear aromatics (PNA), which are also biologically difficult to remove, exhibited a different fate in the two POTW's studied. PNA's are less volatile than the other aromatics on the priority pollutant list, yet these materials were removed. However, the PNA's were concentrated in sludges at the two plants. This seems to indicate that for these less volatile refractory materials, air stripping is not an important removal mechanism. Further evaluations of removal mechanisms will be carried out over the full 40-plant program.

Formation of Chlorinated Hydrocarbons

At both POTW's sampled during the pilot study, treated wastewater was collected immediately before chlorination and at the plant outfall after chlorine disinfection. Samples of the chlorinated final effluent were split, creating duplicate aliquots for analysis. One set was analyzed as collected from the outfall. The other set of samples was preserved by adding sufficient thiosulfate to consume any residual chlorine.

The purpose of collecting duplicate effluent samples, as described above, was to study the possible formation of chlorinated hydrocarbons. If the preserved sample was found to contain a lower concentration of a chlorinated priority pollutant than the unpreserved sample, it was concluded that formation of chlorinated hydrocarbons might continue in the receiving stream after discharge.

In Table VII-7 for Plant A and Table VII-8 for Plant B, summaries of data showing the formation of chlorinated priority pollutants across the disinfection process are presented. In total, evidence of the formation of chlorinated hydrocarbons was detected in 49 individual grab sample sets over a 3-day period at Plant A and in 59 grab sample sets over one week of sampling at Plant B.

By far the most common situation was one in which the chlorinated priority pollutant was not detected in the pre-chlorinated sample but was found at below the detection limit in either of the final effluent samples, or both. Usually this type of result would be considered insignificant; however, since the analyses presented herein were compiled utilizing gc-ms, the results obtained are meaningful. With gc-ms, the identification of an organic molecule is based on an analysis of ion fragments observed in mass spectra. If no ion fragments for a particular molecule at a specified gc detention time are observed, the result is reported as "not detected." This is significantly different from the results that are reported at "less than 10." For these analyses, some fragments were found but not at proper levels to assign a concentration even though the material was probably present. Therefore, for parameters that go from not detected to a value below the detection limit, formation of the chlorinated molecule may be indicated.

The predicted higher chlorinated hydrocarbon concentrations in unpreserved samples as compared to preserved samples did not occur in a consistent manner. However, over the course of the full 40-POTW program it is expected that more definitive data on these phenomena will be developed.

46<

TABLE VII-7
PLANT A 5-30-79
EFFECT OF CHLORINE ON PRIORITY POLLUTANT CONCENTRATIONS

----SAMPLE--- DATE	TIME	PP	PARAMETER NAME	PRE-CHLORINATED EFFLUENT	UNPRESERVED FINAL EFFLUENT	PRESERVED FINAL EFFLUENT
7-26-78	1800	23	CHLOROFORM	LT 10	10	LT 10
7-27-78	1000	23	CHLOROFORM	LT 10	100	LT 10
7-27-78	1800	23	CHLOROFORM	110	190	170
7-28-78	1000	23	CHLOROFORM	LT 10	130	110
7-28-78	1400	23	CHLOROFORM	LT 10	10	LT 10
7-29-78	0200	23	CHLOROFORM	18	32	LT 10
7-29-78	0600	23	CHLOROFORM	LT 10	28	LT 10
7-27-78	0800	25	1,2-DICHLOROBENZENE	N-D	LT 10	NOT APP.
7-29-78	0800	26	1,3-DICHLOROBENZENE	N-D	LT 10	NOT APP.
7-27-78	0800	27	1,4-DICHLOROBENZENE	N-D	LT 10	NOT APP.
7-27-78	0800	28	3,3'-DICHLOROBENZIDINE	N-D	LT 10	NOT APP.
7-27-78	1400	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-27-78	1800	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	0600	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	1000	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	1400	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	1800	29	1,1-DICHLOROETHYLENE	N-D	10	N-D
7-28-78	1800	29	1,1-DICHLOROETHYLENE	N-D	LT 10	N-D
7-29-78	0200	29	1,1-DICHLOROETHYLENE	N-D	LT 10	N-D
7-27-78	0200	30	1,2-TRANS-DICHLOROETHYLENE	N-D	N-D	LT 10
7-27-78	1400	30	1,2-TRANS-DICHLOROETHYLENE	N-D	N-D	LT 10
7-27-78	1800	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-27-78	2200	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	0200	30	1,2-TRANS-DICHLOROETHYLENE	N-D	N-D	LT 10
7-28-78	0600	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-28-78	1000	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	N-D
7-28-78	1400	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	LT 10
7-29-78	0200	30	1,2-TRANS-DICHLOROETHYLENE	N-D	LT 10	N-D
7-27-78	0200	44	METHYLENE CHLORIDE	LT 10	LT 10	17
7-27-78	0200	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
7-27-78	1000	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
7-27-78	1400	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
7-27-78	1800	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
7-28-78	0200	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
7-28-78	0600	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
7-28-78	1000	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
7-28-78	1400	48	DICHLOROBROMOMETHANE	N-D	LT 100	LT 10
7-28-78	1800	48	DICHLOROBROMOMETHANE	N-D	10	N-D
7-28-78	1800	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
7-29-78	0200	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
7-29-78	0600	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
7-28-78	1000	49	TRICHLOROFLUOROMETHANE	N-D	N-D	LT 10
7-28-78	1400	49	TRICHLOROFLUOROMETHANE	N-D	LT 10	LT 10
7-28-78	1800	49	TRICHLOROFLUOROMETHANE	N-D	10	N-D
7-28-78	1800	49	TRICHLOROFLUOROMETHANE	N-D	LT 10	N-D
7-28-78	1400	51	CHLORODIBROMOMETHANE	N-D	LT 10	N-D
7-29-78	0200	51	CHLORODIBROMOMETHANE	N-D	LT 10	N-D
7-27-78	1800	85	TETRACHLOROETHYLENE	LT 10	11	13
7-27-78	0200	87	TRICHLOROETHYLENE	N-D	LT 10	LT 10

NOTES: 1) ALL UNITS IN UG/L UNLESS OTHERWISE NOTED
2) POLLUTANTS WHICH DID NOT EXHIBIT INCREASED CONCENTRATIONS AFTER CHLORINATION ARE NOT LISTED
3) PP - PRIORITY POLLUTANT NUMBER
LT - LESS THAN
N-D - NOT DETECTED
NOT APP. - NOT APPLICABLE (EXTRACTABLE PARAMETERS)

Results of Sampling Frequency and Sample Point Selection Experiments

Through the first seven days of sampling at Plant A influent composites were taken every eight hours, starting at 0800 on Saturday, July 22, 1978 and running through 0800 on Saturday, July 29, 1978. During the second week of sampling at Plant A the composites were changed to cover the entire 24-hour (0800 to 0800) period. On a daily basis the averages of the three 8-hour composites match the corresponding 24-hour composites. The composites which end at 1600 and 1200 have consistently higher loadings than the composites ending at 0800. This phenomena is particularly evident in the metals concentrations which exhibited much higher concentrations during the working hour composites (0800 to 1600) than during the other two 8-hour periods. Table VII-9 shows this phenomenon for the first week of sampling at Plant B.

This phenomenon would follow the diurnal variation in the wastewater flow and the work day of the industrial dischargers, combined with the detention time of the sewer system. This timed, higher loading of the priority pollutants, which were not detected in the Plant B sampling, is further evidence of the contribution from the industrial discharges which was present in Plant A's system, but not in Plant B's system.

TABLE VII-8
PLANT B
EFFECT OF CHLORINE ON PRIORITY POLLUTANT CONCENTRATIONS

5-30-79

----SAMPLE--- DATE	TIME	PP	PARAMETER NAME	PRE-CHLORINATED EFFLUENT	UNPRESERVED FINAL EFFLUENT	PRESERVED FINAL EFFLUENT
8- 9-78	0600	11	1,1,1-TRICHLOROETHANE	N-D	N-D	LT 10
8-13-78	0600	13	1,1-DICHLOROETHANE	N-D	LT 10	N-D
8- 7-78	0200	23	CHLOROFORM	N-D	LT 10	LT 10
8- 9-78	1000	23	CHLOROFORM	N-D	LT 10	LT 10
8-11-78	1000	23	CHLOROFORM	LT 10	LT 10	34
8-11-78	0800	25	1,2-DICHLOROBENZENE	N-D	LT 10	NOT APP.
8- 8-78	0800	26	1,3-DICHLOROBENZENE	N-D	LT 10	NOT APP.
8- 9-78	0800	26	1,3-DICHLOROBENZENE	N-D	LT 10	NOT APP.
8-13-78	0800	26	1,3-DICHLOROBENZENE	N-D	LT 10	NOT APP.
8-13-78	0800	28	3,3'-DICHLOROBENZIDINE	N-D	LT 10	NOT APP.
8- 7-78	0200	29	1,1-DICHLOROETHYLENE	N-D	N-D	LT 10
8-10-78	1000	29	1,1-DICHLOROETHYLENE	N-D	N-D	LT 10
8-10-78	1400	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8-10-78	1800	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8-11-78	0600	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8-11-78	1400	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8-11-78	2200	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8-12-78	1400	29	1,1-DICHLOROETHYLENE	N-D	LT 10	LT 10
8- 6-78	1400	44	METHYLENE CHLORIDE	N-D	LT 10	LT 10
8- 7-78	0200	44	METHYLENE CHLORIDE	N-D	LT 10	LT 10
8- 8-78	1000	44	METHYLENE CHLORIDE	N-D	LT 10	LT 10
8- 9-78	1800	44	METHYLENE CHLORIDE	N-D	LT 10	LT 10
8- 6-78	2200	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
8- 7-78	0200	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
8- 7-78	1400	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	0600	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	1000	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
8- 8-78	1400	48	DICHLOROBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	1800	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
8-10-78	1800	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
8-11-78	1800	48	DICHLOROBROMOMETHANE	N-D	LT 10	N-D
8-11-78	2200	48	DICHLOROBROMOMETHANE	N-D	N-D	LT 10
8- 6-78	1000	51	CHLORODIBROMOMETHANE	N-D	LT 10	LT 10
8- 6-78	1400	51	CHLORODIBROMOMETHANE	N-D	N-D	LT 10
8- 6-78	1800	51	CHLORODIBROMOMETHANE	N-D	LT 10	N-D
8- 6-78	2200	51	CHLORODIBROMOMETHANE	N-D	N-D	LT 10
8- 7-78	0600	51	CHLORODIBROMOMETHANE	N-D	LT 10	LT 10
8- 7-78	1400	51	CHLORODIBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	0600	51	CHLORODIBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	1400	51	CHLORODIBROMOMETHANE	N-D	LT 10	LT 10
8- 8-78	1800	51	CHLORODIBROMOMETHANE	N-D	N-D	LT 10
8-11-78	1800	51	CHLORODIBROMOMETHANE	N-D	LT 10	N-D
8- 7-78	0800	64	PENTACHLOROPHENOL	N-D	LT 10	NOT APP.
8- 6-78	1000	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 6-78	1800	85	TETRACHLOROETHYLENE	N-D	LT 10	N-D
8- 6-78	2200	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 7-78	0600	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 7-78	1400	85	TETRACHLOROETHYLENE	N-D	LT 10	N-D
8- 8-78	1000	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 8-78	1400	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 8-78	1800	85	TETRACHLOROETHYLENE	N-D	LT 10	N-D
8- 9-78	1000	85	TETRACHLOROETHYLENE	N-D	LT 10	LT 10
8- 9-78	1800	85	TETRACHLOROETHYLENE	N-D	LT 10	N-D
8-10-78	1400	85	TETRACHLOROETHYLENE	N-D	N-D	LT 10
8-11-78	2200	85	TETRACHLOROETHYLENE	N-D	N-D	LT 10
8-12-78	1000	85	TETRACHLOROETHYLENE	N-D	N-D	LT 10
8-13-78	0200	85	TETRACHLOROETHYLENE	N-D	N-D	LT 10
8- 7-78	0600	87	TRICHLOROETHYLENE	N-D	N-D	LT 10
8- 8-78	1000	87	TRICHLOROETHYLENE	N-D	LT 10	N-D

NOTES: 1) ALL UNITS IN UG/L UNLESS OTHERWISE NOTED
2) POLLUTANTS WHICH DID NOT EXHIBIT INCREASED CONCENTRATIONS AFTER CHLORINATION ARE NOT LISTED
3) PP - PRIORITY POLLUTANT NUMBER
LT - LESS THAN
N-D - NOT DETECTED
NOT APP. - NOT APPLICABLE (EXTRACTABLE PARAMETERS)

Unless diurnal variation and the effect of sewer detention time are to be subjects of further study, the additional sampling effort and analysis expense to do three or more complete sets of composites per day do not seem to be warranted. Satisfactory results may be obtained with a daily composite.

Variation Between Various Days of the Week

The presence of and variation in influent pollutant concentrations over the weekly sampling period showed a few general trends. At Plant A the priority pollutant metals, especially chromium, copper and nickel, showed a marked increase during the middle and latter parts of the Monday-Friday work week, and their concentrations dipped during the non-working day composites. The same general trend with the metals was noticed at Plant B, but with the smaller industrial contribution and the smaller wastewater flow, the concentrations were not as large, and similarly, the variations not as pronounced.

A general trend for the conventional parameters (BOD and TSS) was not established at either of the pilot plants. Both of the aforementioned conventional pollutants fluctuated up and down throughout the 2-week period at Plant A and the 1-week period in Plant B to such an extent that no meaningful conclusions could be drawn on the daily conventional pollutant variation.

TABLE VII-9 8-HOUR COMPOSITES VS. METALS CONCENTRATIONS[1]

	July 20 — July 23			July 23 — July 24			July 24 — July 25			July 25 — July 26		
	0800	1600	2400	0800	1600[2]	2400[2]	0800	1600	2400	0800	1600	2400
Cadmium	LT2[3]	7	5	9	-	-	LT2	6	3	8	13	11
Chromium	76	151	133	63	-	-	100	884	139	428	1360	563
Copper	35	228	94	70	-	-	105	267	128	154	864	205
Lead	LT20	LT20	LT20	32	-	-	LT20	139	LT20	41	216	29
Nickel	LT10	39	32	19	-	-	31	260	43	39	347	66
Zinc	23	124	116	303	-	-	135	162	379	190	503	223

	July 26 — July 27			July 27 — July 28			July 28 — July 29		
	0800	1600	2400[2]	0800	1600	2400	0800	1600	2400
Cadmium	6	30	-	9	22	12	9	39	18
Chromium	361	1025	-	321	870	364	372	455	311
Copper	101	333	-	152	207	119	157	154	120
Lead	LT20	110	-	LT20	117	21	33	44	86
Nickel	27	273	-	20	269	54	75	63	98
Zinc	149	473	-	303	362	347	197	345	204

[1] All units µg/l

[2] Bottle broken

[3] LT = less than

Due to the very low concentrations of the organics in most of the samples, little correlation on a daily basis could be drawn from the organic results. The variation of toluene during the first week at Plant A showed increased concentrations during the work week, but during the second week, this trend was not shown. With the majority of the analytical results reported as less than 10µg/l for these organics, there would have to be a very heavy organics discharger to the system on a regular basis for these organic results to show any kind of a trend worthy of definitive conclusions. The one organic pollutant which did show up with values consistently above the detection limit was chloroform, with a trend toward higher values at the end of each sample week at Plant A (except for the composite ending on Thursday each week). The values for chloroform in Plant B were always below the detection limit, so a similar comparison could not be made.

Therefore, as discussed above, it is apparent that day-by-day differences may be more readily apparent in treatment facilities with larger industrial contributors, and the amounts of the priority pollutants which are being contributed by the residential contributors are small enough to be diluted below the detection concentrations by the time they reach the treatment plants. Source sampling at industrial dischargers and selected sampling under controlled conditions (i.e., new sewer, little groundwater inflow, etc.) of totally residential areas, may yield trends for those priority pollutants which are introduced into sewers.

Potential of Additional Sample Points

During the first week of sampling at Plant A and the week at Plant B, certain additional points were sampled to scan for priority pollutant levels which might impact mass balances calculated for these or future plants. In addition, certain other waste streams, should they be accessible, may yield sufficient information to warrant future sampling.

Sludge Dewatering/Thickening Recycle Streams

This waste stream is usually readily accessible in the sludge handling system of each POTW and can be sampled to obtain an indication of the level of pollutants which are recycled for further biological treatment. Samples of the filtrate at Plant A show that the priority pollutant concentrations in these streams are generally of such small magnitude that they do not warrant the effort in obtaining them.

If this type of waste stream is recycled in such a way so as to affect another sample point, background sampling should be practiced, on a case-by-case basis only, to provide a total picture of the flow of priority pollutants through the POTW

Floatable

The pollutant levels in the floatables samples taken at Plant A and the corresponding sludge concentrations correlate reasonably well. However, since the volume of floatables removed from the wastewater is very small when compared to the sludge volumes, additional samples of this type are not deemed necessary.

Primary Effluent

One of the principal goals of the 40-plant sampling effort is to determine the fate of priority pollutants by calculating mass balances. A more accurate calculation can be made if all factors are expressed in the same terms (i.e., liquid flow in mg/l rather than solids in mg/kg). To accurately calculate mass balances through the primary treatment process, a sample point in the primary effluent will be needed.

Tap Water

The tap water sample is a necessary background sample which should be obtained at each POTW so that a total understanding of what pollutants are already in the water prior to its use may be ascertained.

Effluent Before Chlorination

Since the use of chlorine as a disinfecting agent has been questioned because of the possible formation of chlorinated hydrocarbons, the collection of effluent before chlorination could offer a means of obtaining valuable information. Should a chlorinated hydrocarbon be detected in all the samples throughout the POTW (influent, sludges, effluent), its fate would still be in question as to whether it was removed in any of the treatment processes or if it was generated in the disinfection process. This doubt on the fate of such compounds would be resolved should the wastewater be sampled both before and after chlorination.

Digester Supernatant/Heat Treatment Recycle Streams

Both of these waste streams are concentrated flows which are liable to contain very high concentrations of conventional, nonconventional and selected priority pollutants. Neither of these streams was sampled at either of the pilot plants, but each could yield valuable data on the processes involved and how they impact the fate of priority pollutants in POTW's.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979 -657-060/5378

Water EPA-440/1-80-301

Fate of Priority Pollutants in Publicly Owned Treatment Works

Interim Report

by
Howard Feiler, P.E.
Burns and Roe Industrial Services Corporation
650 Winters Avenue
Paramus, New Jersey 07652

Program Manager
Thomas P. O'Farrell

Project Officers
Robert M. Southworth, P.E.
Arthur E. Shattuck

Effluent Guidelines Division
Water Regulations and Standards
Office of Water and Waste Management
U.S. Environmental Protection Agency
Washington DC 20460

51<

DISCLAIMER

The purpose of this interim report is to present the data from the first 20 cities in EPA's study to sample and analyze for the 129 priority pollutants at POTWs in 40 cities. Although the report includes a summary of conclusions, the reader should be informed that these are preliminary and based on only one-half of the data. Final conclusions will be presented in the final report based on the data from 40 cities.

TABLE OF CONTENTS

Section — Page

I Summary and Preliminary Conclusions 1
  Summary 1
  Preliminary Conclusions 2

II Introduction 3
  Background 3
  Purpose 3

III POTW Selection 4
  Selection Criteria 4
  POTW Characteristics 5

IV Sampling 16
  Sampling Frequency 16
  Sampling Techniques 16
  Sample Points 17

V Data 24
  Overall POTW Data 24

VI Evaluation of Analytical Results 35
  Impact of Industrial Contribution on Influent Quality 35
  Treatment or Removal of Priority Pollutants in POTW's 35
  Reduction of Priority Pollutants by POTW Treatment Processes 39
  POTW Priority Pollutant Mass Balances 39
  Daily Variation of Influent Pollutant Concentrations 42
  Effect of Rainfall 42
  Formation of Chlorinated Hydrocarbons 45
  Pollutants Detected in Sludges When Not Measured in the Influent 45
  Correlation of Influent and Effluent Concentrations 48

APPENDIX A - CUMULATIVE DISTRIBUTION CURVES 50

  Figure A-1 (Benzene, 1,1,1-Trichloroethane Chloroform) 50

  Figure A-2 (1,2 trans-Dichloroethylene, Ethylbenzene, Methylene Chloride) 51

  Figure A-3 (Tetrachloroethylene, Toluene, Trichloroethylene) 52

TABLE OF CONTENTS (Cont'd)

Section	Page
Figure A-4 (Phenol, Bis(2-Ethylhexyl) Phthalate, Naphthalene)	53
Figure A-5 (Butyl Benzyl Phthalate, Di-N-Butyl Phthalate, Diethyl Phthalate)	54
Figure A-6 (Cadmium, Chromium, Copper)	55
Figure A-7 (Cyanide, Lead Mercury)	56
Figure A-8 (Nickel, Silver, Zinc)	57
APPENDIX B - ANALYTICAL DATA RESULTS	58
Summary, Mass Balance, Percent Occurrence of Pollutant Parameters (Plants 1 through 20)	

LIST OF TABLES

Table No.	Title	Page
1	POTW Characteristics	6
2	Summary of Number of Samples Taken at Each Plant	18
3	Occurrence of Priority Pollutants in POTW Influent Samples	25
4	Occurrence of Priority Pollutants in POTW Secondary Effluent Samples	29
5	Occurrence of Priority Pollutants in POTW Raw Sludge Samples	32
6	Summary of Percent Removals Achieved by Secondary Treatment	37
7	Reduction of Conventional and Priority Pollutants by POTW Treatment Processes	40
8	Mass Balance Summary	41
9	Daily Average Concentrations of Pollutants in POTW Influents	43
10	Effect of Rainfall on Influent Metals Loading	44
11	Formation of Chlorinated Hydrocarbons During Chlorine Disinfection	46
12	Summary of Priority Pollutant Occurrence in Sludge When Not Detected in Influent	47
13	Correlation of Influent and Effluent Concentration	49

LIST OF FIGURES

Figure No.	Title	
1	Correlation of Influent Total Metals Concentration to Percent Industrial Flow	36
2	Cumulative Distribution Curves	38

ACKNOWLEDGEMENTS

The Environmental Protection Agency personnel contributing to this effort were Project Officer, Robert M. Southworth, Effluent Guidelines Division; Program Manager, Thomas P. O'Farrell, Office of the Deputy Assistant Administrator for Water Regulations and Standards; and former Project Officers, Arthur E. Shattuck, Effluent Guidelines Division, and R. Dean Jarman, Office of Research and Development, Center for Environmental Research Information.

Additionally, we gratefully acknowledge the following Environmental Protection Agency personnel for their valuable assistance and guidance: Robert B. Schaffer, Director, Effluent Guidelines Division; Jeffery D. Denit, Deputy Director, Effluent Guidelines Division; and John E. Riley, Branch Chief, Effluent Guidelines Division.

Acknowledgement is also made to Burns and Roe Industrial Services Corporation, Paramus, New Jersey, the EPA contractor for the project. The following members of the technical staff made significant contributions to the overall project effort and execution of the sampling program: Howard D. Feiler, Paul J. Storch, Henry M. Celestino, Gary C. Martin, and Mark V. Sadowski.

I.

SUMMARY AND PRELIMINARY CONCLUSIONS

SUMMARY

In 1978, the United States Environmental Protection Agency (EPA) initiated a program to study the occurrence and fate of the 129 priority pollutants in 40 Publicly Owned Treatment Works (POTW's). The first phase of this work was a two-plant pilot study designed to set operating parameters for the remainder of the 40 POTW study. In October 1979, EPA's Effluent Guidelines Division published a report summarizing the findings of the pilot study work: "Fate of Priority Polluants in Publicly Owned Treatment Works-Pilot Study" (EPA-440/1-79-300).

In this Interim report, data from the two pilot study POTW's plus 18 additional POTW's are presented. All 20 plants provided a minimum of secondary treatment. At most of these 20 plants, a minimum of six days of 24 hour sampling of influent, effluent, and sludge streams was completed. Each sample was analyzed for conventional, selected non-conventional, and priority pollutants.

Beyond presenting the occurrence and concentration of priority pollutants in the 20 POTW's other specific phenomena and relationships are evaluated in this report. These items include:

- Impact of industrial contribution on influent quality.
- Treatment or removal of priority pollutants in POTW's.
- Reduction of priority pollutants by POTW treatment processes.
- POTW priority pollutant mass balances.
- Daily variation of influent priority pollutant concentration.
- Effect of rainfall on priority pollutant levels in POTW influents.
- Formation of chlorinated hydrocarbons during chlorine disinfection.
- Quantification of pollutants found in sludges, but not detected in POTW influents.
- Correlation of influent to effluent priority pollutant levels.

PRELIMINARY CONCLUSIONS

1. A total of 93 priority pollutants were detected at least once in POTW influents.

2. In general, the higher the industrial contribution to a POTW, the higher the concentration of metallic priority pollutants in the POTW influent.

3. Based on the 20 POTW data base, 50 percent of secondary treatment plants achieved at least 76 percent reduction of total priority pollutant metals, 85 percent reduction of total volatile priority pollutants, and 70 percent reduction of total acid-base-neutral priority pollutants.

4. Tertiary treatment processes reduced priority pollutants slightly better than secondary processes. Primary treatment was less effective that either secondary or tertiary processes. Activated sludge and trickling filter processes were about equally effective in reducing priority pollutants.

5. Metallic priority pollutant mass balance was good, but some organic priority pollutants in the influent were always not accounted for in the effluent or sludges. This indicates that, in general, a portion of organic priority pollutants are biodegraded or, in the case of volatiles, stripped out of the wastewater.

6. The mass loading of priority pollutants in POTW influents was higher on weekdays than on weekends.

7. Heavy rainfall increased metallic priority pollutant mass loading at POTW's with combined sewer collection systems.

8. Certain priority pollutant chlorinated hydrocarbons increased in concentration during chlorine disinfection.

9. Some pollutants not measured in POTW influents were regularly measured at high levels in the corresponding sludge streams.

10. For many conventional and priority pollutants, as influent concentrations increased, effluent concentrations also increased.

II.

INTRODUCTION

BACKGROUND

Priority pollutants enter navigable waters from a variety of point and non-point sources. Prior to the initiation of this project, only scattered data existed on the impact, occurrence, and removal of toxic pollutants in POTW's. Very little was known about the quantity of toxic pollutants entering receiving streams from POTW's or the ability of POTW's to treat or remove toxic pollutants.

In this Interim Report, data obtained at the midpoint of the 40 POTW study are presented. A total of 632 samples were collected to make up the 20 plant data base. Each sample was analyzed for conventional and selected non-conventional pollutants, as well as 129 organic and inorganic priority pollutants. The preliminary findings presented in the Interim Report and, to an even larger extent, the final conclusions for the full 40 plant study will provide valuable insights into the quantity and fate of toxic pollutants in POTW's.

PURPOSE

The purposes of the 40 POTW study are to determine:

1. The quantity of priority pollutants in raw sewage.
2. POTW removal efficiencies for priority pollutants.
3. The quantity of priority pollutants in resulting sludge streams.

This report presents results of the analyses of samples collected at the first 20 of the 40 POTWs.

III.

POTW SELECTION

SELECTION CRITERIA

A goal of this project is to obtain priority pollutant data representative of the type of secondary treatment facilities that will exist after completion of EPA's Construction Grants Program. Primary factors considered in selecting the plants include:

1. Treatment processes
2. POTW size
3. Amount of industrial contribution
4. Type of industrial contribution
5. POTW operating efficiency
6. Actual flow as a percent of design capacity
7. POTW location representing all EPA regions.

The 40 POTW's selected for this survey represent the full spectrum of common secondary treatment processes as reflected in the 1978 EPA Needs Survey. However, since activated sludge and trickling filter plants are most prevalent, the 40 plants are heavily weighted with those types. Less common treatment processes, such as a rotating biological contactor and an aerated lagoon, are also included. Within the 20 plant data base, modifications of the activated sludge process such as contact stabilization, Kraus, and pure oxygen are represented as well as some advanced waste treatment processes, notably tertiary mixed media filters.

Although according to the Needs Survey the most numerous POTW's are in the smallest size range, plant selection favors plants over 5 MGD. Two factors serve as the basis for generally including only POTW's over 5 MGD. First, although there are relatively fewer large POTW's, the large plants treat the bulk of wastewater. In addition, the General Pretreatment Regulations primarily affect only POTW's larger than 5 MGD.

Actual flow as a percent of design capacity is also an important selection criteria. Plants operating well below capacity do not give a fair representation of priority pollutant treatment or removal. Although a few of the 20 POTW's operated at a low percentage of their indicated design capacity, these plants generally had a significant percentage of the treatment processes off-line during the week of sampling. For example, at Plant 2, only half of the primary treatment capacity was in use when the plant was sampled. Likewise, at Plant 8, only seven of ten primary and five of nine secondary clarifiers were in operation. At Plant 19, routinely, only 65 percent of the design capacity is on-line.

With regard to industrial flow, POTW's ranging from zero to more than 50 percent industrial contribution are included. Similarly, industries in most of the 34 industrial categories currently under review by the EPA Effluent Guidelines Division are covered by the study. Few plants always meet the 30/30 BOD, TSS secondary treatment requirements, but POTW's are only selected if their operation is reasonably good. Finally, POTW's from each EPA region are included. The number of plants selected are in proportion to the total number of POTW's in that region. As a result, the more densely populated regions are more heavily represented.

POTW Characteristics

In the following paragraphs short summaries describing the treatment process for each of the first 20 plants covered in this Interim Report are presented. Table 1 includes information on the basic characteristics of each POTW. Each of the 20 POTW's provided some form of secondary treatment, and every plant chlorinated its effluent before discharge. Some of the POTW's practice in-plant chlorination for odor control. These operations were generally suspended during the week of sampling.

Plant No. 1

This wastewater treatment facility provides secondary treatment utilizing the conventional activated sludge process. This POTW can provide primary treatment for flows up to 300 MGD.

The treatment unit operations begin with gravity flow from the drainage area to the bar screens and grit chambers, where lift pumps elevate the wastewater for gravity flow through the rest of the plant. After the lift pumps, the wastewater passes through pre-aeration, primary settling, and into the aeration chambers. After aeration, clarification, and chlorination, the treated effluent is discharged to the receiving stream.

Sludge handling at this plant involves primary sludge thickening by gravity thickeners, secondary sludge thickening by dissolved air flotation (DAF), vacuum filtration and incineration.

Plant No. 2

At Plant No. 2, wastewater flows into a diversion chamber, where it is pumped through a rising well and elevated to a height that allows gravity flow to the rest of the plant. Following the rising well, the wastewater passes through parallel grit chambers, comminutors, pre-aeration chambers, and into the primary settling tank. After primary settling, wastewater flows to aeration tanks, secondary clarifiers, chlorination basins, and is then discharged. During the sampling period, Plant 2 had only half of its primary clarifiers and aeration tanks in use. This is why the flow at this plant is reported as only 53 percent of the plant's design capacity, although for the units in use the actual flow is much closer to full capacity.

TABLE 1
POTW CHARACTERISTICS

	PLANT 1	2	3	4	5	6	7	8	9	10
Biological Treatment Process	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS/TF
Secondary Design Flow, MGD	120	15	14	120	25	7.4	66	50	60	30/12
Avg. Daily Flow, MGD, (Historical)	105	8-10	10-11	80-85	26	7	50	20-25	45-50	20/8
Avg. Daily Flow, MGD(1)(Actual)	91.3	8(3)	10.6	83.7	21.7	7.1	48.6	22.8(2)(3)	51.8	16.5/6.9(3)
% Combined/ Separate Sewers	40/60	100% Comb	100% Comb	50/50	100% Sep	100% Sep	10/90	100% Sep	100% Comb	100% Sep
BOD,mg/l, Inf/Eff(1)	215/13	95/14	134/14	152/22	138/13	263/18	169/29	238/42	113/5	242/16
TSS, mg/l Inf/Eff(1)	175/20	97/9	265/44	164/43	147/12	632/27	135/18	205/69	149/14	222/16
% Industrial Contribution	30	5	10	7	10	38	15	10	10	5
Major Industrial Contributors	Pharm., Petro-chemical, Plating, Foundries, Coking, Foods	Grain Storage, Oil/Fuel, Terminals, Machine Tools, Metalwork	Poultry Process, Plastics, Textiles	Beverages, Plating, Paint&Ink Chemicals, Foods, Paper, Photo Process	Auto. Man. Hospitals, Plating, Paper, Photo Process	Plastics + Synthetics, Foundry, Bakery	Plating, Auto. Plants, Furniture Man.	Auto. Man.	Firearms Man.	Elec. Plating, Metal Assembly, Tool&Die Shops, Plastics

(1) Actual recorded value through total treatment (secondary or tertiary) during sampling periods.

(2) 2 MGD treated by trickling filter.

(3) See summary description in text

TABLE 1 (Continued)
POTW CHARACTERISTICS

	PLANT									
	11	12	13	14	15	16	17	18	19	20
Biological Treatment Process	TF	AS	AS + AWT	AS	TF	TF + AS + AWT	TF/AS	AS	Pure O_2 AS	AS + AWT
Secondary Design Flow, MGD	45	45	24	20.6	7.5	150	16/22	100	120	143
Avg. Daily Flow, MGD, (Historical)	41	39	17	13-14	5	140	5/10	82	70	100
Avg. Daily Flow, MGD$^{(1)}$(Actual)	38.5	37.5	15.2	11.2$^{(3)}$	6.6	144.9	5/9.7$^{(3)}$	62.6	67.8$^{(3)}$	119.3
% Combined/Separate Sewers	5/95	100% Sep.	85/15	100% Com.	100% Com.	100% Sep.	100% Com.	100% Com.	100% Sep.	100% Sep.
BOD, mg/l, Inf/Eff$^{(1)}$	99/27	105/10	69/10	281/13	115/13	214/11	194/13 TF 194/9 AS	208/37	379/37	247/8
TSS, mg/l Inf/Eff$^{(1)}$	171/14	178/14	150/6	190/9	131/19	217/4	129/9 TF 129/8 AS	268/21	187/22	421/5
% Industrial Contribution	18	50	33	25	25	16	25	50	20	15-22
Major Industrial Contributors	Elec. Plating, Food Process.	Plating, Food Process., Pharm.	Plating, Meat Pkg., Battery Man.	Plastics, Plating, Paint, Pharm.	Appliance Man. Plating	Food Process., Metal Finishing	Paint, Plating, Aircraft Man.	Breweries, Plating, Canneries, Slaughter-houses	Food Process., Plating, Leather Finishing	Canning, Elec. Paint Man. Deter. Man.

(1) Actual recorded value through total treatment (secondary or tertiary) during sampling periods.
(2) See summary description in text

Primary sludge at this POTW is pumped to sludge holding tanks where it is combined with the thickened (via DAF) waste activated sludge. From this point, the combined sludge passes to the sludge conditioning facilities, where it is heated and pressurized prior to vacuum filtration. The decant from the sludge conditioning system and the filtrate from the vacuum filter are bled to the head of the aeration tanks. The filter cake is incinerated, with the resulting ash being slurried to a diked lagoon on the plant property.

Plant No. 3

At this POTW, the influent is prechlorinated, when required, and all incoming sewer lines join together prior to the bar screens. The flow splits through two parallel screens, and then into two wet wells. The flow is then lifted from these wet wells and continues through the plant by gravity flow. The two flows undergo grit removal and are joined together along with various recycle flows at the feed to the primary settling tanks (no pre-aeration is utilized). Primary effluent flows to the aeration tanks, and after aeration, to one of two covered secondary clarifiers. Flows from the clarifiers are combined prior to chlorination, and the chlorinated effluent flows through one of two parallel chlorine contact chambers. The two effluent streams overflow to a common outfall sewer that discharges to the river 100 feet from shore.

Primary sludge is collected by a bottom scraper that runs continuously and the sludge is pumped to a gravity thickener that concentrates it to eight percent solids. Waste activated sludge is fed to a DAF unit where it is thickened to two percent solids. The two treated sludges are pumped to the sludge dewatering area where lime and ferric chloride are added and vacuum filters produce a filter cake that is trucked to a landfill.

Plant No. 4

This POTW also utilizes the conventional activated sludge process. Wastewater enters through one of three sewer trunk lines, which are each monitored by a magmeter. The influent is prechlorinated for the purpose of controlling odors at the plant. Recycle lines from the centrifuge and the anaerobic digester flow into one of the influent lines before the three lines are combined. From here, the flow splits into four parts, through bar screens and four aerated grit chambers. After recombination, the flow next passes through the primary clarifiers, secondary aeration tanks (diffused air), secondary clarifiers, and the chlorine contact chamber, and is discharged to the receiving stream.

The primary sludge, consisting of four to five percent solids, is pumped continuously to anaerobic digesters. Secondary waste activated sludge is pumped to DAF thickeners where it is concentrated to six to seven percent solids. The DAF subnatant is returned to the aeration tanks. The thickened secondary sludge is sent either to the anaerobic digesters or to centrifuges. At the centrifuges, a polymer is added before the sludge is thickened. Thickened sludge is sent to an incinerator, which is fueled by methane from the digesters. Ash from the incinerator is landfilled.

Plant No. 5

Plant 5 uses the conventional, or plug flow, activated sludge process. The POTW is capable of providing primary treatment for an additional 50 MGD during peak wet weather flow periods. Routinely, approximately two-thirds of the plant's flow receives secondary treatment while the rest receives only primary treatment and chlorination.

Treatment unit operations begin with gravity flow through mechanically cleaned bar screens. Four centrifugal raw wastewater pumps lift the wastewater approximately 35 feet into the plant where it then flows by gravity through the various treatment units. The flow is split, passing through two parallel grit removal basins, four comminutors, four primary clarifiers, six aeration tanks, and then through the four secondary clarifiers. The secondary effluent is chlorinated and discharged to the receiving stream.

This treatment facility stabilizes waste sludge by using a three-stage anaerobic sludge digestion system. Digested sludge is disposed of in four 5-acre sludge storage basins. Digester supernatant is returned to the primary clarifiers. Methane gas from the digesters is utilized to fuel a generator that provides power to operate blowers and pumps.

Plant No. 6

Wastewater is pumped to Plant 6 where it flows by gravity through mechanically-cleaned bar screens and grit chambers. From the grit chambers, the influent is pre-aerated and flows by gravity to the primary clarifiers. The primary treated wastewater then receives secondary treatment in contact stabilization tanks where it is mixed with return sludge that has been aerated. The mixture flows to the secondary clarifiers where settled solids are returned to the sludge aeration basin.

Waste activated sludge is withdrawn from the secondary clarifiers and is pumped to DAF thickener units. The thickened slugde is combined with primary sludge and is pumped to a two-stage anaerobic digestion system. Subnatant from the DAF units and digester supernatant are recylced back to the contact stabilization tanks. Digested sludge is either hauled to landfill or dried in sludge drying beds.

Plant No. 7

At this conventional activated sludge plant, treatment begins when the flow from various influent sewer lines passes through bar screens and through four parallel grit chambers. The combined wastewater from the grit chambers then splits and passes through primary clarifiers arranged as two parallel systems. Primary effluent is aerated in aeration basins and the mixed liquor flows to the secondary clarifiers, after which the effluent is chlorinated and discharged.

Primary sludge and waste activated sludge are removed from the primary tanks and are pumped to two digesters used only as holding tanks. Sludge from these tanks is pumped to a heat treatment system, which generally runs continuously. Heat treated sludge is gravity thickened to 18 percent solids and is then vacuum filtered to 50 percent solids. The heat treatment decant, the thickener overflow, and the vacuum filter filtrate are returned to holding tanks and are gradually recycled to one of the primary systems. The gravity thickeners and vacuum filters do not run continuously. Conditioned sludge is incinerated.

Plant No. 8

This facility uses a combination of trickling filter and activated sludge processes to provide secondary wastewater treatment. Microscreens and re-aeration basins provide additional advanced wastewater treatment. The trickling filter process treats approximately 2 MGD with the remaining flow being treated by the activated sludge process. Half of the aeration tanks were not in use during the week of sampling, because plant flow had not approached design capacity. This is why the actual POTW flow is only 34 percent of the plant's design capacity.

Raw wastewater entering the plant initially passes through bar screens and aerated grit chambers before receiving treatment in primary clarifiers. From the primary clarifiers, wastewater passes through the aeration basins or trickling filters, secondary clarifiers, microscreens, re-aeration basins, and chlorine contact tanks prior to discharge.

Waste activated sludge and trickling filter humus are thickened using air flotation (DAF) and are then combined with primary sludge. The combined sludge is then heat treated and dewatered using vacuum filters. Filtered sludge is incinerated.

Heat treatment decant and vacuum filter filtrate are recycled to the plant influent upstream of the bar screens. DAF subnatant is recycled to the primary settling tank effluent.

Plant No. 9

This POTW treats wastewater using the conventional activated sludge process. The treatment process consists of screening, shredding, grit removal, primary treatment, activated sludge secondary treatment, final settling, and chlorination. The unit operations used in the sludge handling system include thickening, filtration (belt and vacuum), and incineration.

Ash produced during incineration is sluiced to one of two lagoons, and is periodically hauled from these lagoons to a local sanitary landfill.

Plant No. 10

Plant 10 provides wastewater treatment using a combination of the activated sludge process and trickling filter process. The plant also operates a 9 MGD sand filter for tertiary treatment. All of the filtered water is sold as irrigation water, and none is discharged. Tertiary filter backwash is sent to the head of the trickling filter plant.

Influent to the POTW enters from several sewer lines, is combined in a wet well, and then divides between the two plants. Bar screens, grit chambers, and comminutors are utilized before primary treatment. The wastewater then passes through primary clarifiers. In the activated sludge plant, the wastewater flows to one of three aeration tanks. Each tank utilizes both mechanical and diffused aeration, and feeds one of four secondary clarifiers. The secondary clarifiers incorporate a chlorine contact chamber, which is concentric to the tanks. Wastewater flows outward from the overflow weir along the circumference of the tank. After chlorination, the flow from the secondary tanks recombines prior to discharge.

Primary sludge from the activated sludge plant is degritted, gravity thickened, vacuum filtered and pumped to an anaerobic digester. Overflow from the gravity thickener is returned to the secondary system, and vacuum filter filtrate is recycled to the primary influent. Return activated sludge is recycled to the aeration tanks, and waste activated sludge (along with scum) is centrifuged and pumped to an aerobic digester. The centrifuge thickens sludge from 1/2 to 2 percent solids, and the centrate is returned to the primary effluent.

After primary treatment, the wastewater in the trickling filter plant flows through one of three trickling filters (two are currently in use). Two filters have redwood media and one has rock media. The effluent from the filters is recombined and flows to the secondary clarifiers. Effluent from the clarifiers flows through one of two chlorine contact chambers before discharge. Secondary sludge from the trickling filter plant is returned to the head of the primary tanks in the trickling filter plant.

Combined sludge from the primary tanks is pumped to an anaerobic digester. All digested sludge from both the aerobic and anaerobic digesters is trucked to a landfill.

Plant No. 11

Raw wastewater entering this trickling filter facility first flows through bar screens, grit chambers, and then additional bar screens. The influent is both pre-aerated and prechlorinated, before it undergoes primary treatment in one of four primary clarifiers. After primary treatment, the wastewater is recombined and flows to one of eight trickling filters. Trickling filter effluent flows to the secondary clarifiers and is then chlorinated and piped to a drainage canal which flows to the receiving stream. Trickling filter effluent receives a low dosage of chlorine prior to secondary clarification for algae control.

This POTW also operates a post treatment system for some secondary effluent by means of an activated sludge plant. Most of this water is used internally by the plant for equipment cleaning and lawn sprinkling. At times, some of this activated sludge effluent is discharged with the total plant effluent. One secondary clarifier is used exclusively for the post treatment system.

Secondary sludge is recycled back to the primary clarifiers. Combined sludge from the primary clarifiers and the waste activated sludge from the post treatment system are anaerobically digested without intermediate thickening or dewatering. Digested sludge is pumped to drying beds. Skimmings are currently hauled away and dried sludge is sold as fertilizer.

Plant No. 12

The treatment unit operations at this facility begin with raw sewage passing through bar screens, and then flowing to one of ten primary clarifiers. After primary clarification, the wastewater flows to mechanically aerated basins and then to the secondary clarifiers. Final treated effluent from the secondary clarifiers passes through a chlorine contact chamber and is discharged.

Primary sludge is cyclone centrifuged for grit removal before it is combined with the waste activated sludge. Combined sludge is then thickened in gravity thickeners, dewatered on vacuum filters, and then hauled to a landfill.

Plant No. 13

In addition to secondary treatment, this conventional activated sludge plant provides advanced wastewater treatment by passing secondary effluent through mixed-media filters. As the influent enters the plant, it passes through bar screens, grit chambers and then splits at a ratio of two to one into two parallel primary and secondary treatment systems.

Effluent from the secondary clarifiers flows to screw pumps where it is lifted to mixed-media filters. The wastewater then flows by gravity through the filters and is discharged. The primary and waste activated sludges are combined and then anaerobically digested. Digested sludge is applied as fertilizer to farmlands.

Plant No. 14

This treatment plant provides secondary treatment using the activated sludge process. As the wastewater enters the plant, it passes through bar screens, comminutors and is then pumped to an aerated grit chamber. Wastewater then passes through primary clarifiers and an aeration tank. From the aeration tank, the wastewater passes through secondary clarifiers, and a chlorine contact chamber prior to discharge.

Waste activated sludge is recycled to the primary clarifiers. The combined sludge is pumped to a nearby plant for final disposal after it has been digested by a two-stage anaerobic digestion system.

Actual flow is reported as only 54 percent of design capacity at this plant. The correct percent of design capacity in use is much higher because certain sections of the plant were off line during the week of sampling.

Plant No. 15

This 45 year old treatment facility provides secondary treatment using a fixed nozzle 1 1/2 acre trickling filter. Wastewater enters the plant via two trunk lines: one transmitting only domestic flow; and the other carrying all of the industrial flow. The two lines receive separate treatment in aerated grit chambers, then are combined and flow to six parallel primary tanks. Primary effluent is gravity fed to the trickling filters and is followed by three parallel secondary clarifiers. Effluent from the secondary clarifiers is pumped to a 2 1/2 acre polishing lagoon. A section of the lagoon is baffled for use as a chlorine contact chamber.

Return sludge and digester decant are returned to the head of three of the six primary tanks. The sludge from the primary tanks is pumped to digesters, and is eventually dewatered on drying beds.

Plant No. 16

This POTW provides wastewater treatment using a unique combination of two parallel trickling filter plants, followed by additional activated sludge treatment, and mixed-media filtration. Of the nearly 150 MGD treated, approximately 80 MGD receive tertiary treatment while the remainder receive only secondary treatment.

The parallel plants are serviced by separate interceptors. Both systems provide grit removal, and primary clarification. One system uses a two-stage trickling filter configuration, and the other system uses a standard single-stage trickling filter. Both systems provide secondary clarification and pump part of their effluent to the teritary system. The remaining effluent is combined with tertiary effluent, and is then chlorinated and discharged.

Waste sludge from the trickling filter plants is treated by anaerobic digestion and sludge from the teritary plant is treated by aerobic digestion. Digested sludge is then pumped 22 miles for subsoil injection.

Plant No. 17

This plant was originally constructed as a trickling filter POTW, but has been enlarged with the installation of a parallel activated sludge plant.

The two parallel plants have a common head works but separate effluent lines.

The treatment unit operations of the trickling filter plant begin with grit removal, followed by primary clarification, secondary treatment, and then secondary clarification. The activated sludge plant treatment unit operations begin with grit removal, followed by primary clarification, aeration, and secondary clarification. Influent flow is regulated to each system by automatic gate valves. The activated sludge plant treats approximately two thirds of the total plant influent.

Primary and secondary sludge from the trickling filter plant is combined with primary sludge from the activated sludge plant and is then thickened and anaerobically digested. Waste activated sludge from the activated sludge plant is aerobically digested. All digested sludge is sent to a lagoon.

Plant No. 18

Plant No. 18 provides secondary treatment using the activated sludge process. When influent enters the POTW, it first passes through a grit removal chamber and bar screens. After this preliminary treatment, the wastewater flows to one of eight primary clarifiers. Primary effluent then flows through aeration tanks to one of eight secondary clarifiers. Final secondary effluent is chlorinated, with contact occurring in a three-mile long underground discharge sewer.

Primary sludge is processed by cyclone degritters, gravity thickeners, and anaerobic digesters. The waste activated sludge is centrifuged before aerobic digestion. All digested sludge is stored in a lagoon for land application. Sludge from two other POTW's, accounting for approximately ten percent of the total sludge, is pumped to this plant and treated in the digesters.

Plant No. 19

This POTW, recently upgraded from a primary to a secondary treatment facility, utilizes the high purity oxygen activated sludge process. Wastewater is prechlorinated in an influent wet well, passes through bar screens, grit chambers, aerated grit chambers (high flow periods only), primary sedimentation, and into the pure oxygen reactors. Secondary effluent after clarification is chlorinated and then dechlorinated using sulfur dioxide before discharge to a 1-1/2 mile underground outfall sewer.

Waste activated sludge is centrifuged and combined with the primary sludge for anaerobic digestion. Digested sludge is vacuum filtered. The digester supernatant and vacuum filter filtrate are combined with other recycle lines (scum thickener supernatant, grit dewatering overflow, and cooling water from the oxygen generator) and returned to the headworks prior to the bar screens.

Although the actual flow is reported as only 55 percent of design flow, since entire treatment units were not in operation, this percent is low. True plant utilization was much higher.

Plant No. 20

This advanced wastewater treatment facility currently uses the Kraus nitrification modification of the activated sludge process. Wastewater enters this facility in three trunklines, combining just prior to bar screens. After screening, the wastewater passes through eight parallel grit tanks and into a set of 26 primary sedimentation tanks. Effluent from primary settling is combined and flows to the 16 aeration tanks and to a system of 26 secondary clarifiers. Effluent from all clarifiers is combined underground and flows to one of two parallel nitrification systems. Nitrified effluent is pumped to four mixed media filters. Filtered effluent is chlorinated and dechlorinated prior to discharge.

All recycle lines (filter wash water, drying bed decant) enter the system at the discharge from the grit tanks. Waste activated sludges and nitrification sludges are DAF thickened, combined with the primary sludge, and digested anaerobically. The digested sludge is dewatered on drying beds.

IV.

SAMPLING

SAMPLING FREQUENCY

A six day sampling period, excluding Sundays, was selected for this study based on both the findings of the Pilot Study and logistic and budgetary factors. Consequently, for 16 of the 20 POTW's covered, six days of sampling were completed. At Plants 3 and 8, only, four days of sampling were completed. For Plant 3, the shorter sampling period was planned to permit analytical capacity for three 8-hour influent composites per day. At Plant 8, POTW operating problems necessitated shortening the sampling program. The only exception to no Sunday sampling was a set of samples collected at Plant 9 on a Sunday. This sample was collected to coordinate sampling periods with another EPA project occurring simultaneously in the same city.

The two POTW's covered in the Pilot Study (Plants 1 and 2) were sampled for a longer period of time and more intensely than those sampled afterward. At Plant 1, influent, effluent, and sludge streams were sampled over 24 hours for seven consecutive days. Influent was collected three times daily as 8-hour composites during the first seven consecutive days, and then as one 24-hour composite daily for an additional seven days. At Plant 2, seven consecutive days of 24-hour sampling were completed.

SAMPLING TECHNIQUES

Generally, uniform sampling techniques were used at the POTW's sampled in this study. These techniques are described in detail in the Pilot Study report. To obtain the most representative sample from each sample point, automatic samplers were used wherever possible to gather frequent equal-sized sample aliquots. This procedure was only possible where flows were continuous and accessible by automatic sampling equipment.

At the early plants, automatic sampler tubing was changed daily and sampler blanks were run before beginning each day's new composite. Later in the program, for budgetary reasons, this procedure was discontinued, with fresh Teflon tubing used only when a sampler was set up at a new collection point. The automatic samplers were calibrated to pull sample aliquots of at least 100 ml, at time intervals not to exceed 30 minutes. The actual quantity and frequency of sample aliquots was governed by the depth of the waste stream relative to the automatic samples. Composites in the automatic samplers were collected in 2.5-gallon glass jars that were kept in an ice bath at 4°C for the entire 24-hour period of sampling.

In those cases where wastewater or sludge flows were intermittent or not pumpable, such as primary sludge, grab sampling was practiced. Grab samples were also taken where prescribed by EPA's sampling protocol. All grabs were collected at least six times a day, and often more frequently.

On occasion, as dictated by sample point configuration, samples were grabbed via an intermediate vessel. This method of sampling is a modification to the protocol for fractions, such as oil and grease, where the sample container is supposed to be filled directly from the wastewater stream. This modification was made at a few sample points for safety and practical reasons since positioning of the sample container into most of these waste streams was either impossible or very dangerous, and the induced error through use of an intermediate beaker was of lesser consequence. In all cases where an intermediate beaker was used, it was used exclusively at one point for the duration of sampling at the plant, and it was repeatedly purged with fresh sample before each sample was collected.

SAMPLE POINTS

Sample points were selected to characterize both the influent and effluent stream toxic pollutant levels, toxic pollutants in sludge and, by combining these data, toxic pollutant mass balances through the POTW. Other sample points were selected to best characterize wastewater and sludges at particular stages of treatment. At each plant, an effort was made to select sample points in such a way that any extraneous factors that might affect the validity of the sample would be eliminated. This involved selecting sample points that allowed sample collection before settling, volatilization, or contamination from other waste streams or recycle flows.

Table 2 lists all samples taken during the 20-plant program. In the following paragraphs each sampling point type is briefly described.

Influent (Total) - Generally, total influent samples were collected prior to pre-aeration, grit removal, or recycle streams such as digester decant. To avoid automatic sampler tube fouling where possible, influent samples were collected downstream of bar screens. When access to the influent was such that representative samples could not be taken via automatic sampling, grab composite aliquots were collected every two hours. When a total influent sample was not available prior to any interferences or because of access problems or multiple influent streams, upstream samples of separate flows were taken and manually composited to create a total influent sample.

TABLE 2
SUMMARY OF NUMBER OF SAMPLES TAKEN AT EACH PLANT

PLANT 1 THROUGH 10

SAMPLE LOCATION	1	2	3	4	5	6	7	8	9	10	TOTAL SAMPLES
INFLUENT (TOTAL)	28	7	12	6	6	6	6	4	6	6	87
SECONDARY EFFL. (UNCHLORINATED)	3	7	4	-	-	-	6	-	-	6	26
SECONDARY EFFLUENT (CHLORINATED)	7	7	4	6	6	6	-	4	6	6	52
SECONDARY EFFLUENT (OTHER)	-	-	-	-	-	-	-	-	-	6	6
PRIMARY SLUDGE (RAW)	7	-	-	-	-	6	-	3	6	-	22
PRIMARY SLUDGE (THICKENED)	-	-	4	-	-	-	-	-	-	-	4
PRIMARY SLUDGE (DIGESTED)	-	-	-	-	-	-	-	-	-	6	6
COMBINED SLUDGE-RAW FROM PRIMARY	-	-	-	6	6	-	-	-	-	4	16
COMBINED SLUDGE (UNTREATED)	7	-	-	-	-	-	6	-	-	-	13
COMB. SLUDGE-SECONDARY THICKENED	-	7	-	-	-	-	-	4	-	-	11
COMBINED SLUDGE (BOTH THICKENED)	-	-	4	-	-	-	-	-	-	-	4
COMBINED SLUDGE (DIGESTED)	-	-	-	6	6	6	-	-	-	-	18
COMBINED SLUDGE (HEAT TREATED)	-	-	-	-	-	-	6	4	-	-	10
WASTE ACT. SLUDGE (UNTREATED)	7	1	-	-	-	-	-	-	6	-	14
WASTE ACT. SLUDGE-DAF THICKENED	-	1	-	-	-	-	-	-	-	-	1
W.A.S. (OTHER THICKENED)	-	-	-	-	-	-	-	-	-	2	2
SECONDARY SLUDGE (UNTREATED)	-	-	-	-	-	-	-	-	-	4	4
TAP WATER	1	1	1	-	-	-	-	-	-	-	3
HEAT TREATMENT DECANT	-	-	-	-	-	-	6	4	-	-	10
GRAVITY THICKENER OVERFLOW	-	-	1	-	-	-	-	-	-	-	1
VACUUM FILTER FILTRATE	1	-	-	-	-	-	-	-	-	-	1
FLOTABLES	7	-	-	-	-	-	-	-	-	-	7
COMBINATION OF SOURCES	-	-	-	-	-	-	-	-	-	2	2
TOTAL											320

TABLE 2 (CONT.)
SUMMARY OF NUMBER OF SAMPLES TAKEN AT EACH PLANT

PLANT 11 THROUGH 20

SAMPLE LOCATION	11	12	13	14	15	16	17	18	19	20	TOTAL SAMPLES
INFLUENT (TOTAL)	6	6	6	6	6	6	6	6	6	6	60
INFLUENT (OTHER)	-	-	-	6	6	6	-	-	-	-	18
PRIMARY EFFLUENT	-	6	-	-	-	-	-	-	6	-	12
SECONDARY EFFL. (UNCHLORINATED)	6	-	6	-	3	-	-	6	6	6	33
SECONDARY EFFLUENT (CHLORINATED)	6	6	-	6	3	6	6	-	6	-	39
SECONDARY EFFLUENT (OTHER)	-	-	-	-	-	-	6	-	-	-	6
TERTIARY EFFLUENT (CHLORINATED)	-	-	6	-	-	6	-	-	-	6	18
PRIMARY SLUDGE (RAW)	-	6	6	-	1	-	6	-	6	6	31
PRIMARY SLUDGE (THICKENED)	-	-	-	-	-	-	-	6	-	-	6
COMBINED SLUDGE-RAW FROM PRIMARY	6	-	-	6	3	6	-	-	-	-	21
COMBINED SLUDGE (BOTH THICKENED)	-	-	-	-	-	-	6	-	-	-	6
COMBINED SLUDGE (OTHER)	-	-	-	-	-	6	-	-	-	-	6
WASTE ACT. SLUDGE (UNTREATED)	-	6	6	6	-	-	6	6	6	6	42
SECONDARY SLUDGE (UNTREATED)	6	-	-	-	-	-	-	-	-	-	6
TAP WATER	-	-	-	1	1	1	1	1	1	-	6
NITRIFICATION SLUDGE	-	-	-	-	-	-	-	-	-	2	2
TOTAL											312

Influent (Other) - At three of the plants covered in this Interim Report, additional influent points were sampled. At Plant 14 an additional set of samples was taken on the industrial side influent. At Plant 15 an additional set of samples was taken at the City's second treatment plant (domestic sewage only). Plant 16 plant had two treatment trains that were both sampled independently. The same criteria were used in choosing the Influent (Other) points as were applied to the Influent (Total) points.

Primary Effluent - At two of the 20 POTW's, primary settling tank overflows, prior to secondary treatment, were sampled. In both instances, automatic samplers were set up in the channel between primary and secondary treatment. The channels represented the well-mixed combined effluent flow from all primary tanks.

Secondary Effluent (Unchlorinated) - At 11 of the 20 plants, samples were collected prior to chlorine disinfection. This sample was collected either at the secondary clarifier overflow or in the channel leading to the chlorine contact chamber or discharge pipe. In the majority of plants the next step in the treatment process was chlorine disinfection, but in some plants additional treatment prior to disinfection was practiced. At other plants the unchlorinated effluent was the last accessible sampling point before final discharge.

Secondary Effluent (Chlorinated) - This sample point represents the effluent from the chlorine contact chamber, prior to discharge to the receiving water.

Secondary Effluent (Other) - Two of the 20 POTW's had two chlorinated effluent discharge conduits; one each for separate activated sludge and trickling filter processes. One of the points was considered secondary effluent (chlorinated) and for clarity the other was labeled "Secondary Effluent (Other)." Automatic samplers were used at both points.

Tertiary Effluent (Chlorinated) - Three of the plants covered in this Interim Report utilized mixed media filtration as a tertiary treatment step. At each of these plants an additional sample was taken after the mixed media filters. In each case the wastewater was chlorinated after the filters and prior to the accessible sample point.

Primary Sludge (Raw) - At each plant an attempt was made to sample the primary sludge as it was removed from the primary settling tanks, before any further treatment. Samples of the sludge were always collected as grab composites for two reasons: sludge consistency and lack of continuous availability. The majority of these samples were taken from taps either on the sludge pumps themselves or on the lines conveying the sludge to storage or further treatment. Occasionally, the sludge point would be in a rising well controlled by telescoping valves. The consistency of this sample varied depending upon the means utilized by the respective plants for drawing the sludge from the primary tanks. Samples were taken so as to attempt to represent the average sludge consistency. This involved collecting sludge grabs spaced over the sampling day, or grab composites spanning definite pumping periods.

Primary Sludge (Thickened) - At two of the plants the raw primary sludge was not accessible, necessitating collection of primary sludge after gravity thickening. Sampling procedures and techniques for this point were the same as the sampling procedures for the raw primary sludge.

Primary Sludge (Digested) - At one plant the raw primary sludge was pumped directly to digesters, with no accessible intermediate taps or valves for sampling. Consequently, a sample of the digested primary sludge was taken. This sample was collected from a pump tap as a manual grab composite.

Combined Sludge (Raw from Primary) - A number of plants recycle their secondary sludge directly back into the primary settling tanks. At these plants a combined sludge sample was taken in the same manner described previously for primary sludge. These samples were composited directly from the primary tanks, prior to any sludge conditioning.

Combined Sludge (Untreated) - At one of the 20 POTWs sludge from the primary tanks was not accessible and a sample of the sludge after it had combined with the waste activated sludge was taken. At another plant a manual flow composite sample of both primary and waste activated sludges was taken and analyzed as a combined sample of the total waste sludge being removed from the system.

Combined Sludge (Secondary Thickened) - This sample is the same as "Combined Sludge - Untreated" except that the wasted secondary sludge had already been thickened prior to combination with the primary sludge.

Combined Sludge (Both Thickened) - At the two plants where sludge from the secondary settling tanks was not immediately accessible, samples were taken after the sludge had been gravity thickened and combined with the thickened primary sludge.

Combined Sludge (Digested) - At three of the plants covered in this report the secondary sludge by itself was not accessible prior to digestion, so that a combined sludge sample after digestion was taken.

Combined Sludge (Heat Treated) - In an effort to explore the effects of the heat treatment process on toxic pollutants in sludge treatment, sludge samples from two heat treatment systems at POTW's covered in this study were sampled.

Combined Sludge (Other) - At one plant which had two parallel treatment trains, two separate primary settling tank sludges were sampled. At this particular plant, the primary tank sludges included the waste secondary sludges because the waste secondary sludges were recycled to the head of the primary settling basin.

Waste Activated Sludge (Untreated) - Waste activated sludge (WAS) sample points varied from plant to plant, depending on WAS stream accessibility. At some plants, WAS was accessible in rising wells prior to sludge conditioning. If the rising wells were sufficiently mixed, automatic samplers were used to gather WAS samples. At plants without rising wells, or when the well was not mixed, samples were taken from taps on the sludge pumps. Often, however, there were no accessible sampling points on the WAS line. In these cases, since WAS and return activated sludge are usually identical, samples were taken from the return sludge pumps or return sludge lines.

Waste Activated Sludge (DAF Thickened) - At one plant covered in this report, an additional sample of the waste activated sludge was taken after it had been conditioned in a dissolved air flotation system. This was a single grab sample.

Waste Activated Sludge (Other Thickened) - At another POTW, two manually collected composite samples were taken of the waste activated sludge after centrifugation. The samples were taken from a tap on the pump conveying the thickened sludge to the digesters.

Secondary Sludge (Untreated) - These samples represent the trickling filter humus collected at two of the plants covered in this report. Manual composite samples were taken at both plants because sludge consistency and availability prevented using automatic sampling.

Nitrification Sludge - One of the 20 POTW's followed its activated sludge process with nitrification. At this plant two grab samples of the waste nitrification sludge were taken. These samples were taken directly from the waste sludge pumps as single grab samples.

Heat Treatment Decant - At the two plants sampled that conditioned the sludge by heat treatment, decant or supernatant samples from the heat treated sludge holding tanks were manually composited to correspond to the "Combined Sludge (Heat Treated)" samples taken from the same plant. At Plant 7, these samples were taken from a sample tap on the side of the decant tank (gravity flow), while at Plant 8 the decant samples were grabbed from the sludge decant tank overflow weir.

Gravity Thickener Overflow - A single grab sample of the overflow from the gravity thickener was taken at Plant 3. The sample was taken directly from the overflow weir.

Vacuum Filter Filtrate - A single grab sample of the filtrate from the vacuum filter at Plant 1 was grabbed from the pressure line from the filters. All fractions were filled as one grab sample via an intermediate vessel.

Floatables - Also at Plant 1, a complete set of samples of the skimmings from the primary settling tanks was taken. Manual composite samples were gathered by dipping into the floating layer at the collection end of the primary settling tanks.

Combination of Sources - At Plant 10, two manual composite samples of the aerobic digester feed were taken. The sample was a combination of the thickened waste activated sludge and the floatables. Manual samples were taken at this point from a tap on the sludge feed pump.

Tap Water - Background samples of the domestic water as supplied to the plants' service areas were taken at 9 of the 20 plants covered in this report. Samples were taken at a frequently used sink within the plant premises. The tapwater was allowed to run for a period of time prior to sample collection.

V.

DATA

OVERALL POTW DATA

At the first 20 plants of the 40 plant study, 632 individual samples were collected and analyzed for toxic pollutants. Combining data from all liquid and sludge samples, in total, 103 toxic pollutants were measured at least once at levels above their detection limits. The toxic pollutants never found include acrolein, benzidine, hexachloroethane, hexachlorocyclopentadiene, nitrobenzene, several ethers, all nitrosoamines, endosulfans and metabolites, endrin and metabolites, all but two PCB mixtures, and toxaphene.

Tables 3 and 4 present occurrence data and concentration ranges for POTW influent and secondary effluent samples. In influent samples across the 20-plant data base, 93 toxic pollutants were measured at least once above their detection limits. Likewise, in secondary effluents, 84 toxic pollutants were found at levels above their detection limits. Finally, of the 24 toxic pollutants found in more than 50 percent of the influent samples, all were detected less frequently in effluent samples.

In all, 76 toxic pollutants were found in raw sludges. For the purposes of this discussion, raw sludges include thickened sludges. Table 5 summarizes the occurrence of these pollutants in sludges across the 20 POTW data base. Twelve of the 15 most frequently occurring and most highly concentrated toxic pollutants in raw sludge are metals.

Figures A-1 to A-8 in Appendix A present cumulative distribution curves of pollutant removal and effluent concentration for selected priority pollutants. These curves are discussed in Section VI.

Tables B-1 to B-60 in Appendix B present detailed data summaries for each of the 20 POTW's. For each plant, a Summary of Analytical Data is included which presents averages of each pollutant parameter found at each sample point covered. A Mass Balance is also included for each POTW. In these tables, the average pounds per day of each pollutant entering the POTW are tabulated, as well as the daily pounds exiting the POTW. Finally, for each POTW, a Summary of Percent Occurrence is presented that tabulates the percent of times each pollutant was found at each sampling point at each plant.

TABLE 3

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW INFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
ZINC	146	100	UG/L	23	7680
COPPER	146	100	UG/L	34	1190
CYANIDE	150	99	UG/L	3	2500
CHROMIUM	146	99	UG/L	8	2380
TOLUENE	152	98	UG/L	2	500
TETRACHLOROETHYLENE	152	97	UG/L	2	1100
CHLOROFORM	152	96	UG/L	1	430
METHYLENE CHLORIDE	152	95	UG/L	1	11000
TRICHLOROETHYLENE	152	95	UG/L	1	860
BIS(2-ETHYLHEXYL) PHTHALATE	152	94	UG/L	2	390
1,1,1-TRICHLOROETHANE	152	91	UG/L	1	1600
NICKEL	146	87	UG/L	11	1930
ETHYLBENZENE	152	86	UG/L	1	448
SILVER	146	84	UG/L	2	77
PHENOL	152	83	UG/L	1	380
LEAD	146	79	UG/L	16	935
CADMIUM	146	71	UG/L	1	1800
MERCURY	146	70	NG/L	200	3900
BENZENE	152	68	UG/L	1	1560
DI-N-BUTYL PHTHALATE	152	63	UG/L	1	105
DIETHYL PHTHALATE	152	62	UG/L	1	33
BUTYL BENZYL PHTHALATE	152	59	UG/L	2	140
1,2-TRANS-DICHLOROETHYLENE	152	58	UG/L	1	97
NAPHTHALENE	152	55	UG/L	1	150
1,1-DICHLOROETHANE	152	40	UG/L	1	24
1,1-DICHLOROETHYLENE	152	35	UG/L	1	243
1,2-DICHLOROBENZENE	152	30	UG/L	2	440
PENTACHLOROPHENOL	152	27	UG/L	2	94
ANTHRACENE	152	27	UG/L	1	93

TABLE 3 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW INFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
PHENANTHRENE	152	27	UG/L	1	93
GAMMA-BHC	152	23	NG/L	20	500
1,4-DICHLOROBENZENE	152	23	UG/L	2	200
ARSENIC	146	16	UG/L	2	80
ANTIMONY	146	14	UG/L	1	192
DIMETHYL PHTHALATE	152	13	UG/L	5	18
METHYL CHLORIDE	152	12	UG/L	3	270
CARBON TETRACHLORIDE	152	11	UG/L	2	1900
CHLOROBENZENE	152	11	UG/L	1	5
1,2-DICHLOROPROPANE	152	11	UG/L	1	5
DICHLOROBROMOMETHANE	152	10	UG/L	1	4
PYRENE	152	9	UG/L	5	84
2,4-DIMETHYLPHENOL	152	9	UG/L	1	55
1,3-DICHLOROBENZENE	152	9	UG/L	3	92
TRICHLOROFLUOROMETHANE	152	9	UG/L	1	22
FLUORANTHENE	152	9	UG/L	5	5
DI-N-OCTYL PHTHALATE	152	8	UG/L	5	210
1,2-DICHLOROETHANE	152	8	UG/L	1	59
SELENIUM	146	8	UG/L	1	20
VINYL CHLORIDE	152	7	UG/L	28	3900
1,1,2-TRICHLOROETHANE	152	6	UG/L	2	135
PCB-1242	152	5	NG/L	2300	49600
HEPTACHLOR	152	5	NG/L	80	500
1,1,2,2-TETRACHLOROETHANE	152	5	UG/L	3	52
FLUORENE	152	5	UG/L	5	5
2,4,6-TRICHLOROPHENOL	152	5	UG/L	1	6
ALPHA-BHC	152	5	NG/L	50	3000
1,2,4-TRICHLOROBENZENE	152	5	UG/L	3	32

TABLE 3 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW INFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
PARACHLOROMETA CRESOL	152	5	UG/L	1	31
2,4-DICHLOROPHENOL	152	5	UG/L	1	12
2-CHLOROPHENOL	152	5	UG/L	1	5
CHRYSENE	152	4	UG/L	5	5
1,2-BENZANTHRACENE	152	4	UG/L	5	5
CHLORODIBROMOMETHANE	152	4	UG/L	1	2
DICHLORODIFLUOROMETHANE	152	3	UG/L	45	1000
METHYL BROMIDE	152	3	UG/L	18	130
1,3-DICHLOROPROPYLENE	152	3	UG/L	4	8
INDENO(1,2,3-C,D) PYRENE	146	2	UG/L	5	5
BERYLLIUM	146	2	UG/L	1	4
ISOPHORONE	152	2	UG/L	5	18
HEXACHLOROBENZENE	152	2	UG/L	1	20
BENZO (A)PYRENE	152	2	UG/L	5	10
ACENAPHTHENE	152	2	UG/L	5	5
11,12-BENZOFLUORANTHENE	152	2	UG/L	5	5
BIS(2-CHLOROETHYOXY) METHANE	141	1	UG/L	5	5
1,12-BENZOPERYLENE	146	1	UG/L	5	35
1,2:5,6-DIBENZANTHRACENE	146	1	UG/L	5	5
3,4-BENZOFLUORANTHENE	150	1	UG/L	5	5
ALDRIN	152	1	NG/L	5000	5000
PCB-1254	152	1	NG/L	3400	5500
4,4'-DDD	152	1	NG/L	310	770
HEPTACHLOR EPOXIDE	152	1	NG/L	230	500
DIELDRIN	152	1	NG/L	30	40
2,4-DINITROTOLUENE	152	1	UG/L	5	8
CHLOROETHANE	152	1	UG/L	3	5

TABLE 3 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW INFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
THALLIUM	146	1	UG/L	4	4
BETA-BHC	152	1	NG/L	1000	1000
DELTA-BHC	152	1	NG/L	500	500
1,2-DIPHENYLHYDRAZINE	152	1	UG/L	10	10
2,4-DINITROPHENOL	152	1	UG/L	7	7
ACENAPHTHYLENE	152	1	UG/L	5	5
HEXACHLOROBUTADIENE	152	1	UG/L	5	5
2,6-DINITROTOLUENE	152	1	UG/L	5	5
BROMOFORM	152	1	UG/L	1	1

(1) MINIMUM OF VALUES ABOVE DETECTION LIMIT ONLY
PRELIMINARY DATA ONLY-TO BE VERIFIED

TABLE 4

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW SECONDARY EFFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
ZINC	130	98	UG/L	21	1200
COPPER	130	96	UG/L	3	243
CYANIDE	126	94	UG/L	2	2211
BIS(2-ETHYLHEXYL) PHTHALATE	129	91	UG/L	2	370
METHYLENE CHLORIDE	130	88	UG/L	1	1570
CHLOROFORM	130	88	UG/L	1	61
CHROMIUM	130	84	UG/L	2	178
TETRACHLOROETHYLENE	130	82	UG/L	0	320
NICKEL	130	81	UG/L	11	579
DI-N-BUTYL PHTHALATE	129	59	UG/L	1	92
1,1,1-TRICHLOROETHANE	130	57	UG/L	1	370
TRICHLOROETHYLENE	130	54	UG/L	1	97
TOLUENE	130	48	UG/L	0	1100
CADMIUM	130	37	UG/L	2	82
GAMMA-BHC	130	36	NG/L	10	840
LEAD	130	35	UG/L	20	217
MERCURY	129	33	NG/L	200	1100
SILVER	130	28	UG/L	1	19
PHENOL	129	27	UG/L	1	89
BENZENE	130	21	UG/L	1	29
ETHYLBENZENE	130	21	UG/L	1	11
DICHLOROBROMOMETHANE	130	19	UG/L	1	5
1,2-TRANS-DICHLOROETHYLENE	130	15	UG/L	1	12
ANTIMONY	130	15	UG/L	1	69
PENTACHLOROPHENOL	129	14	UG/L	3	52
DIETHYL PHTHALATE	129	13	UG/L	1	6
1,1-DICHLOROETHYLENE	130	13	UG/L	1	11
BUTYL BENZYL PHTHALATE	129	12	UG/L	1	10
ARSENIC	130	12	UG/L	1	72

TABLE 4 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW SECONDARY EFFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
1,2-DICHLOROBENZENE	129	9	UG/L	1	27
CHLORODIBROMOMETHANE	130	8	UG/L	1	5
ALPHA-BHC	130	8	NG/L	28	740
SELENIUM	130	8	UG/L	1	103
METHYL CHLORIDE	130	7	UG/L	2	440
ANTHRACENE	129	6	UG/L	1	32
PHENANTHRENE	129	6	UG/L	1	32
VINYL CHLORIDE	130	5	UG/L	2	200
1,1-DICHLOROETHANE	130	5	UG/L	1	3
1,4-DICHLOROBENZENE	129	5	UG/L	2	9
CARBON TETRACHLORIDE	130	5	UG/L	1	67
TRICHLOROFLUOROMETHANE	130	5	UG/L	2	14
NAPHTHALENE	129	4	UG/L	5	5
1,3-DICHLOROBENZENE	129	4	UG/L	5	5
2,4-DICHLOROPHENOL	129	4	UG/L	1	3
BETA-BHC	130	4	NG/L	40	70
1,2-DICHLOROETHANE	130	4	UG/L	1	8
PYRENE	129	3	UG/L	5	5
CHRYSENE	129	3	UG/L	1	5
1,2-BENZANTHRACENE	129	3	UG/L	1	5
PCB-1242	130	3	NG/L	750	2600
BERYLLIUM	130	3	UG/L	1	12
1,1,2,2-TETRACHLOROETHANE	130	3	UG/L	1	5
CHLOROBENZENE	130	3	UG/L	1	3
1,2-DICHLOROPROPANE	130	3	UG/L	1	1
ACENAPHTHENE	128	2	UG/L	1	2
DI-N-OCTYL PHTHALATE	129	2	UG/L	5	13
DIMETHYL PHTHALATE	129	2	UG/L	5	5
FLUORANTHENE	129	2	UG/L	5	5

TABLE 4 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW SECONDARY EFFLUENT SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
2-NITROPHENOL	129	2	UG/L	5	5
2,4-DIMETHYLPHENOL	129	2	UG/L	2	5
PARACHLOROMETA CRESOL	129	2	UG/L	1	4
2,4,6-TRICHLOROPHENOL	129	2	UG/L	1	1
ALDRIN	130	2	NG/L	1000	5000
1,12-BENZOPERYLENE	123	2	UG/L	4	4
4-NITROPHENOL	129	2	UG/L	5	100
HEXACHLOROBENZENE	129	2	UG/L	7	10
ISOPHORONE	129	2	UG/L	5	12
ACENAPHTHYLENE	129	2	UG/L	5	5
3,3'-DICHLOROBENZIDINE	129	2	UG/L	5	5
FLUORENE	129	2	UG/L	1	5
2,4-DINITROTOLUENE	129	2	UG/L	1	2
METHYL BROMIDE	130	2	UG/L	37	190
DICHLORODIFLUOROMETHANE	130	2	UG/L	58	58
INDENO(1,2,3-C,D) PYRENE	123	1	UG/L	5	5
1,2:5,6-DIBENZANTHRACENE	123	1	UG/L	5	5
2-CHLOROPHENOL	129	1	UG/L	5	5
4,6-DINITRO-O-CRESOL	129	1	UG/L	2	2
HEPTACHLOR EPOXIDE	130	1	NG/L	500	500
PCB-1254	130	1	NG/L	500	500
4,4'-DDD	130	1	NG/L	230	230
CHLORDANE	130	1	NG/L	200	200
DIELDRIN	130	1	NG/L	40	40
HEPTACHLOR	130	1	NG/L	30	30
1,1,2-TRICHLOROETHANE	130	1	UG/L	6	6

(1)MINIMUM OF VALUES ABOVE DETECTION LIMIT ONLY
PRELIMINARY DATA ONLY-TO BE VERIFIED
TWO SECONDARY EFFLUENTS INCLUDED FOR PLANTS 10 AND 17

TABLE 5

OCCURRENCE OF PRIORITY POLLUTANTS
IN POTW RAW SLUDGE SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
CYANIDE	200	98	UG/L	60	245000
COPPER	200	98	UG/L	100	180000
ZINC	201	98	UG/L	410	1100000
CADMIUM	200	98	UG/L	12	95000
SILVER	200	97	UG/L	15	6450
CHROMIUM	200	96	UG/L	110	160000
NICKEL	200	95	UG/L	12	84000
TOLUENE	203	95	UG/L	1	42300
LEAD	201	95	UG/L	80	170000
BIS(2-ETHYLHEXYL) PHTHALATE	203	95	UG/L	20	35000
ARSENIC	202	94	UG/L	5	6000
ANTIMONY	193	89	UG/L	3	2000
SELENIUM	194	80	UG/L	5	140000
MERCURY	199	78	NG/L	110	690000
ETHYLBENZENE	205	73	UG/L	1	4200
BENZENE	205	69	UG/L	1	694
METHYLENE CHLORIDE	205	63	UG/L	1	3308
1,2-TRANS-DICHLOROETHYLENE	205	62	UG/L	1	96000
ANTHRACENE	203	53	UG/L	6	3200
PHENANTHRENE	203	53	UG/L	6	3200
PHENOL	203	52	UG/L	19	17000
TRICHLOROETHYLENE	201	50	UG/L	1	4690
PYRENE	203	46	UG/L	6	1700
DI-N-BUTYL PHTHALATE	203	45	UG/L	14	1600
BUTYL BENZYL PHTHALATE	203	42	UG/L	4	45000
1,1-DICHLOROETHANE	205	42	UG/L	1	2885
TETRACHLOROETHYLENE	205	37	UG/L	1	2800
FLUORANTHENE	203	34	UG/L	8	1200
NAPHTHALENE	203	33	UG/L	11	5200
BERYLLIUM	202	32	UG/L	2	65

TABLE 5 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW RAW SLUDGE SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
1,2-BENZANTHRACENE	203	26	UG/L	9	1500
CHRYSENE	202	25	UG/L	9	1500
VINYL CHLORIDE	204	19	UG/L	8	62000
1,1,1-TRICHLOROETHANE	205	18	UG/L	1	1900
1,1,2,2-TETRACHLOROETHANE	203	16	UG/L	1	1044
CHLOROBENZENE	205	15	UG/L	1	290
CHLOROFORM	205	15	UG/L	1	40
THALLIUM	200	14	UG/L	1	31
1,2-DICHLOROPROPANE	204	13	UG/L	1	103
1,4-DICHLOROBENZENE	203	12	UG/L	34	12000
DICHLOROBROMOMETHANE	205	12	UG/L	7	260
1,2-DICHLOROBENZENE	203	10	UG/L	20	1319
TRICHLOROFLUOROMETHANE	205	10	UG/L	2	113
CHLOROETHANE	205	9	UG/L	5	71000
METHYL CHLORIDE	205	9	UG/L	10	6100
1,2,4-TRICHLOROBENZENE	203	8	UG/L	38	950
PENTACHLOROPHENOL	203	8	UG/L	10	6000
DICHLORODIFLUOROMETHANE	205	8	UG/L	7	4300
1,3-DICHLOROBENZENE	203	7	UG/L	38	1900
FLUORENE	203	7	UG/L	31	1300
DIETHYL PHTHALATE	203	7	UG/L	27	786
3,4-BENZOFLUORANTHENE	203	6	UG/L	2	2400
1,1-DICHLOROETHYLENE	205	5	UG/L	1	14000
METHYL BROMIDE	200	5	UG/L	33	30000
CHLORODIBROMOMETHANE	204	5	UG/L	10	75
2,4-DICHLOROPHENOL	203	4	UG/L	14	298
CARBON TETRACHLORIDE	205	4	UG/L	5	940
ACENAPHTHENE	203	3	UG/L	6	4600
DI-N-OCTYL PHTHALATE	203	3	UG/L	37	1024

TABLE 5 (CONT.)

OCCURRENCE OF PRIORITY POLLUTANTS IN POTW RAW SLUDGE SAMPLES

PARAMETER	NUMBER OF SAMPLES ANALYZED	PERCENT OF TIMES DETECTED	UNITS	MINIMUM(1)	MAXIMUM
2-CHLOROPHENOL	203	3	UG/L	11	72
1,1,2-TRICHLOROETHANE	203	3	UG/L	1	2100
11,12-BENZOFLUORANTHENE	204	3	UG/L	40	140
DIMETHYL PHTHALATE	203	2	UG/L	29	650
HEXACHLOROBENZENE	203	2	UG/L	28	780
ACRYLONITRILE	205	2	UG/L	20	290
1,2-DICHLOROETHANE	205	1	UG/L	1	1
BENZO (A)PYRENE	203	1	UG/L	302	490
2,4,6-TRICHLOROPHENOL	203	1	UG/L	11	16
HEXACHLOROBUTADIENE	203	<1	UG/L	2700	2700
2-CHLORONAPHTHALENE	203	<1	UG/L	1600	1600
ACENAPHTHYLENE	203	<1	UG/L	610	610
1,12-BENZOPERYLENE	203	<1	UG/L	130	130
1,2:5,6-DIBENZANTHRACENE	203	<1	UG/L	50	50
INDENO(1,2,3-C,D) PYRENE	203	<1	UG/L	40	40
4,4'-DDE	205	<1	NG/L	10000	10000
1,3-DICHLOROPROPYLENE	205	<1	UG/L	19	19

(1)MINIMUM OF VALUES ABOVE DETECTION LIMIT ONLY
PRELIMINARY DATA ONLY-TO BE VERIFIED

VI.

EVALUATION OF ANALYTICAL RESULTS

IMPACT OF INDUSTRIAL CONTRIBUTION ON INFLUENT QUALITY

The amount of industrial discharge to the 20 POTW's ranged from less than 5 percent to a maximum of 50 percent of their average flow (see Table 1). Review of the influent priority pollutant data reveals that, in general, the higher the industrial contribution, the greater the concentration and to a lesser extent the greater the occurrence of priority pollutants in POTW influents. Figure 1 is a plot of the sum of influent priority pollutant metal concentrations versus percent industrial contribution. Although there is a fair amount of data point scatter, the least squares fit has a large positive slope (R=0.491, slope = 72.86 μg/l/%). This indicates a tendency for total metals concentrations to increase when percent industrial flow increases. The fits were not as good for the sums of other priority pollution fraction sums (organics, volatiles, base-neutrals, acids). This may be because a straight line does not describe the data or because of inaccuracies in the percent industrial figures.

TREATMENT OR REMOVAL OF PRIORITY POLLUTANTS IN POTW's

In the Appendix, Figures A-1 to A-8 present cumulative distributions for the percent removal and effluent concentrations for the 24 priority pollutants most prominent in POTW influents. Table 6 summarizes the data presented in Appendix A for pollutants where 10 or more usable data points are available. In Table 6 and Appendix A, percent removals are presented for two subgroups of analytical data: removals when the priority pollutant level in the influent was measured at a plant average level greater than zero, and removals when the plant average influent pollutant concentration was always measured above 10 μg/l. In Table 6, the number of data points for each subgroup is indicated by N. Minimum percent removals and effluent levels can be read directly from Appendix A figures for any desired percent of POTW's in the data base.

Table 6 shows that, when present at any measurable level, 50 percent of the POTW's samples achieved minimum priority pollutant metal removals ranging roughly between 32 and 81 percent. For common organic priority pollutants, 50 percent of the POTW's achieved minimum removal between 53 and 90 percent.

Figure 2 presents cumulative distributions for the three major priority pollutant fractions. These curves summarize the data presented in Appendix A and in Table 6. In Figure 2, all less-than values were averaged as zero

FIGURE 1

CORRELATION OF INFLUENT TOTAL METALS
CONCENTRATION TO PERCENT INDUSTRIAL FLOW

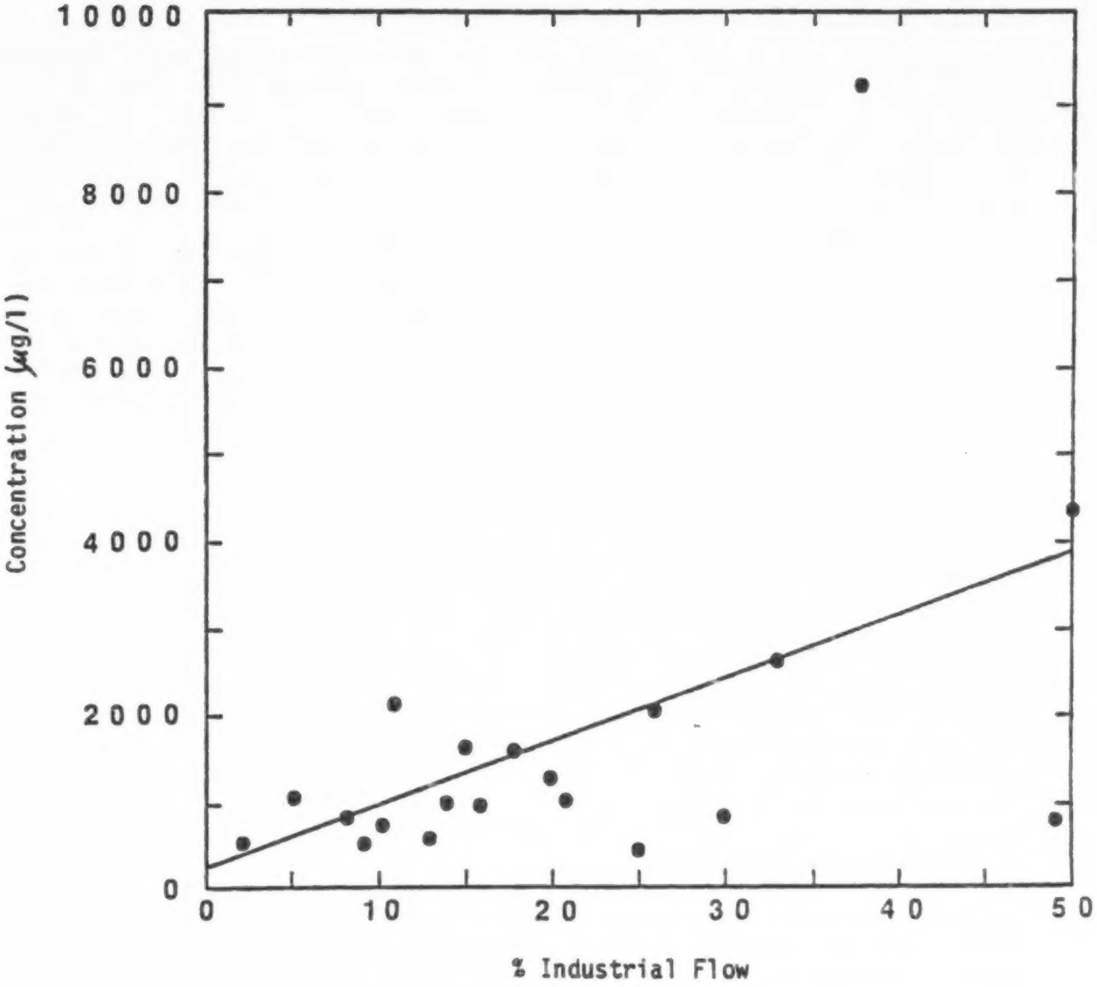


TABLE 6

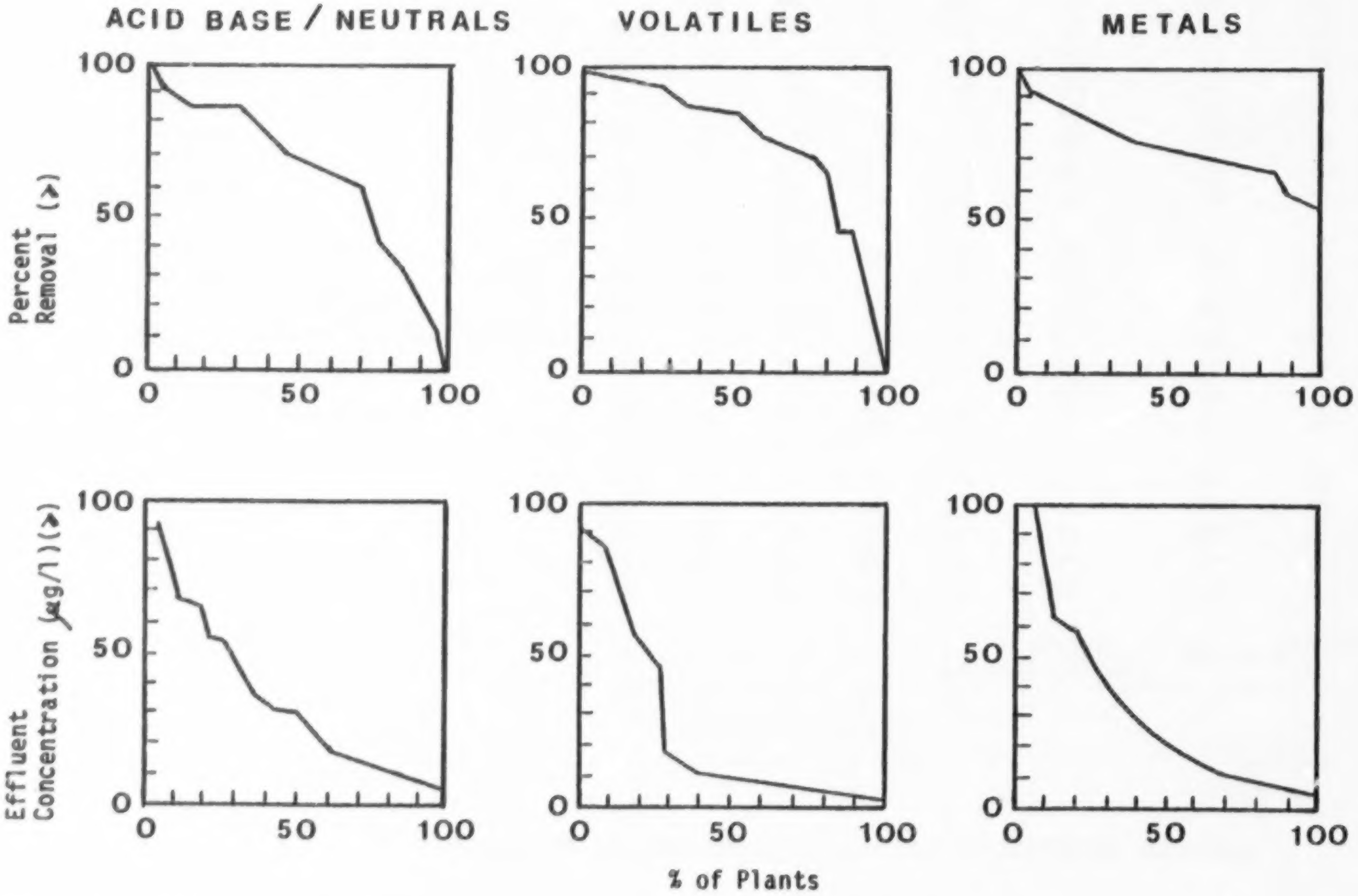
SUMMARY OF PERCENT REMOVALS ACHIEVED BY SECONDARY TREATMENT

	Influents > 0 µg/l						Influents ≥ 10 µg/l	
		Percent of Plants						
		50	75	80	90			
		Percent Removal						
Parameter	N					Median	N	Median
BOD	20	91	83	83	79	91	20	91
TSS	20	91	87	84	74	92	20	92
COD	20	82	76	71	62	83	20	83
Total Phenols	20	77	46	45	40	77	20	77
TOC	20	71	62	61	59	71	20	71
1,1,1 Trichloroethane	18	85	82	69	38	86	16	88
Ethylbenzene	19	81	70	50	0	61	12	89
Methylene Chloride	20	54	31	27	0	55	16	55
Bis (2-Ethylhexyl) Phthalate	20	53	33	33	0	53	18	60
Tetrachloroethylene	20	80	50	25	0	82	15	86
Toluene	20	90	67	57	25	92	17	94
Trichloroethylene	20	85	71	50	0	86	16	90
Chromium	19	71	67	64	44	73	19	75
Copper	20	81	68	64	59	82	20	82
Cyanide	20	53	0	0	0	54	20	54
Lead	18	52	0	0	0	53	18	55
Mercury	17	55	0	0	0	55	17	55
Nickel	19	32	17	9	0	32	18	32
Silver	20	71	50	43	0	73	10	81
Zinc	20	78	66	65	55	80	20	80

Notes: Plant averages used as basis for percent removal calculation.
N - Number of data points included.
Values reported below their detection limit were averaged as 0 in influents, and as the detection limit in effluents.

FIGURE 2

CUMULATIVE DISTRIBUTION CURVES



Notes: All less than values averaged as 0.

to avoid attaching significance to pollutants that were not present in either the influent or effluent samples. This procedure will slightly overstate removal of pollutants measured near their detection limit, but these cases have minimal impact on the totals presented in Figure 2.

REDUCTION OF PRIORITY POLLUTANTS BY POTW TREATMENT PROCESSES

Table 7 summarizes the average of the individual POTW percent removals for selected conventional and priority pollutants achieved by the major treatment processes. For pure oxygen activated sludge, one plant's data are included. Primary and tertiary effluents were sampled at two plants while twelve activated sludge processes and three trickling filter processes were evaluated.

Table 7 shows that among the treatment processes examined, tertiary treatment removed 16 of 24 priority pollutants better than either trickling filter or activated sludge processes. For pure oxygen activated sludge processes, less than half of the removals (10 of 24) were higher than either trickling filter or activated sludge removals. Three-quarters of the trickling filter removals (18 of 24) were better than the corresponding activated sludge removals. Primary treatment appears to be generally less effective than secondary treatment processes in removing the 24 selected priority pollutants.

At two of the POTW's (10 and 17), parallel activated sludge and trickling filter plants treated common influent streams. At both plants, the effluent streams were completely separate allowing for a true comparison of removal efficiencies. The trickling filter and activated sludge conventional pollutant removals were all within six percentage points of each other. For the 32 priority pollutants measured in the influents, 13 were treated to the same degree by both processes, 8 priority pollutants were better removed by activated sludge, 11 were better removed by the trickling filter process. The only priority pollutants that had large differences between trickling filter and activated sludge removals were tetrachloroethylene (trickling filter 13 points higher) and chromium (activated sludge 34 points higher).

POTW PRIORITY POLLUTANT MASS BALANCES

As described in Section V, mass balances for each conventional, nonconventional, and priority pollutant are included in Appendix A. In these mass balance tables, pollutants biodegraded or otherwise treated should show a lower mass exiting the plant than entering it. For conservative pollutants, such as metals, which cannot be degraded, but only transferred to sludge streams, in theory the mass balances should show the same pounds into the plant as leaving it. Table 8 summarizes the mass balance for five POTW's where the percent difference between total pounds of total metals in the incoming and outgoing streams were within ten percent. At these five plants, it is assumed that the balances for all other pollutants are equally accurate.

TABLE 7

REDUCTION OF CONVENTIONAL AND PRIORITY POLLUTANTS BY POTW TREATMENT PROCESSES

		Percent Removal				
Fraction	Parameter	Primary Treatment(1)	Trickling Filter(2)	Activated Sludge(3)	Activated Sludge(4)	Tertiary Treatment(5)
Conventionals	BOD	17	93	95	90	95
	Total Suspended Solids	39	94	94	88	98
	COD	13	62	90	80	91
	Oil and Grease	52	69	89	90	71
Organics	Benzene	23	96	95	99+	99+
	1,1,1 - Trichloroethane	47	92	87	38	99
	Chloroform	23	60	79	11	25
	1,2 - Trans-Dichloroethylene	68	98	57	99+	99+
	Ethylbenzene	25	92	92	80	98
	Methylene Chloride	14	47	77	27	92
	Tetrachloroethylene	-	78	82	-	98
	Toluene	-	87	71	96	99
	Trichloroethylene	30	96	89	44	99
	Phenol	55	96	13	99+	99
	Naphthalene	0	99+	28	99+	-
	Bis (2-Ethylhexyl) Phthalate	-	54	78	40	60
	Butyl Benzyl Phthalate	36	97	48	99+	99+
	Di-N-Butyl Phthlate	99+	0	31	99+	64
	Diethyl Phthlate	11	96	10	99+	99+
Metals	Cadmium	-	74	92	99+	99+
	Chromium	0	74	91	76	87
	Copper	24	89	90	84	88
	Cyanide	57	81	71	53	-
	Lead	-	94	74	99+	97
	Mercury	-	99+	54	86	86
	Nickel	-	25	60	18	51
	Silver	17	95	83	99+	99+
	Zinc	27	80	86	83	87

(1) Two Plant data base

(2) Three Plant data base

(3) Seventeen plant data base

(4) One plant data base

(5) Three plant data base

TABLE 8

Mass Balance Summary

(Pounds/Day)

	Metals			Total Organics			Volatiles			Base Neutrals			Process
Plant No.	In	Out	%	In	Out	Percent Difference	In	Out	Percent Difference	In	Out	Percent Difference	
2	35.9	32.6	-9	6.6	4.9	-26	3.2	2.3	-28	3.4	2.6	-24	Activated Sludge
5	97.2	91.5	-6	176.3	103.2	-41	168.9	95	-44	7.4	8.2	+11	Activated Sludge
7	649	610.2	-6	155.4	80.2	-48	64.6	23.2	-64	90.8	57	-37	Activated Sludge
11	510.2	549.1	+8	185.3	45.3	-76	159.3	19.6	-88	26	25.7	-1	Trickling Filter
20	936.8	917.6	-2	320.1	80.8	-75	263.2	45.1	-83	56.9	35.7	-37	Activated Sludge

Table 8 shows that total priority pollutant metals mass deficiencies ranged between a gain of eight percent and a loss of nine percent, while total organics were always lost. For total organic priority pollutants, losses ranged between 26 and 76 percent.

For the total volatile priority pollutants, mass was always lost. For the volatiles, percent loses ranged between 28 and 88 percent. For the base-neutral priority pollutants, mass balance differences ranges between a gain of 11 percent and a 37 percent loss. At each plant, more organics were lost than metals and more volatiles were lost than either total organics or base-neutrals.

The results discussed above support the concept that metals are conservative in a treatment process while organics are either biodegraded or otherwise lost. The greater loss of volatiles compared to total organics or base-neutrals also supports the idea that volatiles may be stripped out of the wastewater during aeration in addition to being biodegraded.

DAILY VARIATION OF INFLUENT POLLUTANT CONCENTRATIONS

Table 9 presents the daily average concentration of selected conventional and nonconventional pollutants and the sum of the toxic pollutant analytical fraction concentrations in influent samples. With the exception of Sundays, at least one 24-hour composite influent sample was taken on each day of the week at each POTW, providing a minimum of 20 data points to make up the average for each parameter. Less than ten Sunday samples were taken and these were mostly 8-hour composites at Plant 1.

Table 9 does not reveal any particular concentration trend among the five working days. None of the five days of the week showed a consistently higher or lower concentration. However, for every toxic pollutant fraction (except pesticides) as well as BOD and COD, the Friday and Monday averages were always higher than the Saturday or Sunday average. The Sunday data should be viewed cautiously because of the abbreviated data base it represents. Comparing averages for the five working days with the weekend levels, in each case the work week average was higher than any Saturday or Sunday average.

EFFECT OF RAINFALL

During the week of sampling at five of the 20 POTW's, at least one day of heavy rainfall occurred. Table 10 presents the influent total priority pollutant metals loadings at these plants before and after the rainfall day and the average of all other days' loadings. Three of these five plants have combined sewers, one has separate sewers, one is half combined and half separate. At Plants 4, 6 and 14, it was raining on the first day of sampling; at the other two plants, at least one day of dry weather sampling was completed before rainfall began.

TABLE 9

DAILY AVERAGE CONCENTRATIONS OF POLLUTANTS IN POTW INFLUENTS

Fraction	Day of the Week							
	M	T	W	Th	F	Sa	Su	M-F Average
BOD (mg/l)	193	196	206	204	182	150	121	196
COD (mg/l)	447	523	401	575	546	362	250	496
Phenols, Total (µg/l)	94	77	80	108	216	64	55	115
Volatiles (µg/l)	536	598	1047	450	401	243	364	606
Base Neutrals (µg/l)	98	57	90	74	72	65	45	78
Acids (µg/l)	30	20	10	18	24	14	7	20
Toxic Metals (µg/l)	1646	1778	1835	1882	1819	1123	520	1792
Pesticides (ng/l)	424	2171	2178	2743	330	1344	0	1569

TABLE 10

EFFECT OF RAINFALL ON INFLUENT METALS LOADING

PLANT NO.	SEWER TYPE	Influent Pounds of Total Metals DAY OF HEAVY RAINFALL	 DAY AFTER HEAVY RAINFALL	 AVERAGE OF ALL OTHER DAYS
4	50% Combined	1287	402	391
6	Separate	354	336	547
9	Combined	197	101	231
14	Combined	171	125	151
18	Combined	825	250	271

Table 10 shows that at each plant with combined sewers the loading on the day of heavy rainfall was significantly higher than the loading on the following day. At the one POTW with separate sewers, the loading on the day after rainfall was only marginally lower. Table 10 also presents the average of influent total metals loadings. For three of the four combined sewer plants, this loading was lower than the heavy rainfall day's loading. At Plant 6, which has separate sewers, the average of other days was considerably higher.

FORMATION OF CHLORINATED HYDROCARBONS

Table 11 presents a summary of occurrences where the secondary or tertiary chlorinated effluent had a higher concentration of a chlorinated hydrocarbon than the corresponding prechlorinated secondary effluent. Inconsequential data points were excluded from consideration by specifying that the post chlorinated sample had to exceed the prechlorinated sample's detection limit. Most of the pollutants in Table 11 with less than ten reported occurrences of higher chlorinated hydrocarbon levels can be explained by some normal degree of variation between concentrations within the same order of magnitude. Control tests run on some frequently occurring nonchlorinated compounds also indicated several instances of concentration increase through chlorination.

For chloroform, there were 28 instances where it increased in concentration through the chlorination process. The average prechlorinated concentration was 5 μg/l for these occurrences, and the average chlorinated effluent was 14 μg/l. For dichlorobromomethane, there were 16 instances where it increased (from 2 μg/l to 9 μg/l, average). Methylene chloride, gamma-BCH, and chlorodibromomethane also increased more often than can be explained by random variation.

POLLUTANTS DETECTED IN SLUDGES WHEN NOT MEASURED IN THE INFLUENT

Table 12 presents a summary of the priority pollutants that were detected in one or more sludge streams but were not detected in the corresponding influent sample. In many cases this occurs because the influent concentrations were too low to be measured, but the pollutant may have concentrated sufficiently in the sludge stream to be quantified. For example, arsenic and antimony were both detected in less than 20 percent of all POTW influent samples. However, both were detected consistently in sludge streams. Arsenic was detected 56 times in a primary sludge at an average concentration of 397 μg/l when it was not detected in the influent. It was also detected 39 times in combined sludges (85 μg/l average) and 60 times in secondary sludges (331 μg/l) under the same conditions.

TABLE 11

FORMATION OF CHLORINATED HYDROCARBONS DURING CHLORINE DISINFECTION

Parameter	Number of Occurrences	Prechlorinated Effluent Average(1)	Chlorinated Effluent Average(1)
1,1,1, Trichloroethane	3	27	33
Chloroform	28	5	14
1,1, Dichloroethylene	3	1	3
Methylene Chloride	15	28	45
Methyl Chloride	2	195	390
Dichlorobromomethane	16	2	9
Chlorodibromomethane	10	1	10
Tetrachloroethylene	9	9	13
Trichloroethylene	5	7	12
Aldrin (ng/l)	5	1200	4400
Gamma-BHC (ng/l)	11	53	109

(1) All units µg/l unless otherwise noted.

TABLE 12

SUMMARY OF PRIORITY POLLUTANT OCCURRENCE IN SLUDGE WHEN NOT DETECTED IN INFLUENT

Pollutant	No. of Times Detected in any Sludge Stream(1)	Avg. Conc. In Primary Sludge(1)	Avg. Conc. In Combined Sludge(1)	Avg. Conc. In Secondary Sludge(1)
Arsenic	94	397 (56)	85 (39)	331 (60)
Antimony	91	221 (53)	42 (31)	303 (59)
Selenium	91	123 (47)	43 (26)	1340 (57)
Pyrene	73	190 (31)	60 (13)	180 (45)
Anthracene/Phenanthrene	72	350 (33)	1590 (7)	411 (40)
Benzo anthracene/chrysene	52	388 (20)	39 (5)	177 (30)
Fluoranthene	52	152 (21)	48 (10)	140 (34)
Beryllium	47	22 (22)	9 (8)	15 (43)
Cadmium	39	425 (26)	95 (26)	436 (17)
Benzene	38	9 (25)	2 (14)	79 (18)
1,2-trans Dichloroethylene	38	504 (30)	37 (11)	706 (11)
Di-n-butyl Phthalate	34	354 (21)	88 (6)	555 (14)
Vinyl Chloride	31	2120 (17)	260 (7)	1820 (9)
Butyl Benzyl Phthalate	29	1260 (15)	487 (4)	804 (11)
Chlorobenzene	29	13 (9)	6 (6)	81 (20)
1,1,2,2-Tetrachloroethane	25	467 (12)	8 (10)	37 (10)
1,2-Dichloropropane	25	9 (7)	(0)	31 (18)
Mercury	24	93 (13)	31 (18)	135 (13)
Lead	22	12100 (9)	1700 (13)	8630 (15)
Naphthalene	22	259 (9)	313 (3)	755 (11)
Ethylbenzene	21	180 (13)	4 (5)	337 (12)
Nickel	19	4960 (13)	1740 (9)	4440 (9)
Chloroethane	19	12400 (8)	2060 (2)	1490 (12)
Methyl Chloride	16	287 (6)	15 (2)	98 (10)
Dichlorofluoromethane	15	775 (6)	46 (6)	633 (6)

Note: All concentrations are in μg/l.
Values in parentheses are the number of such occurrences.

(1) When not detected in influent.

The pollutants in Table 12 include metals, volatile and base neutral priority pollutants. Those with the highest concentration in the primary sludge when not found in the influent were chloroethane, lead, nickel, vinyl chloride, and butyl-benzyl phthalate. These five pollutants and selenium also had the highest average concentration in secondary sludges. The same five pollutants plus naphthalene and anthracene/phenanthrene were also the highest in combined sludge streams.

CORRELATION OF INFLUENT AND EFFLUENT CONCENTRATIONS

For all of the priority pollutants that occurred in over 50 percent of the influent samples, the correlation between plant average influent concentration and effluent concentration was tested. Table 13 presents the results for metal and volatile priority pollutants. For the acid and base-neutral fractions, no meaningful correlations were calculated. This is probably because the individual pollutants in these fractions were present at very low levels; frequently below or near their detection limits. Only bis-2-ethylhexyl phthalate had an average influent concentration of over 20 µg/l. Its regression coefficient was 0.581 with a slope 0.325 and an intercept of 8.5. For several other parameters the correlations were excellent, and on average they were good, considering the data base includes only 20 plants.

For all metals except mercury, the slope of the line computed by the least squares fit was between 0.04 and 0.52, indicating that half or more of an incremental increase in influent concentration would be removed. Interestingly, the highest slope was obtained for nickel, which also had the lowest median removal of the common heavy metals (see Table 6).

The volatile priority pollutants exhibited the same general tendencies as the metals. Correlation coefficients ranged between 0.262 and 0.937. The slopes of the best fit line ranged between 0.03 and 0.8.

Based on the data in Table 13, it is reasonable to conclude that for many priority pollutants an increase in the influent concentration will result in an increase in effluent concentration.

TABLE 13

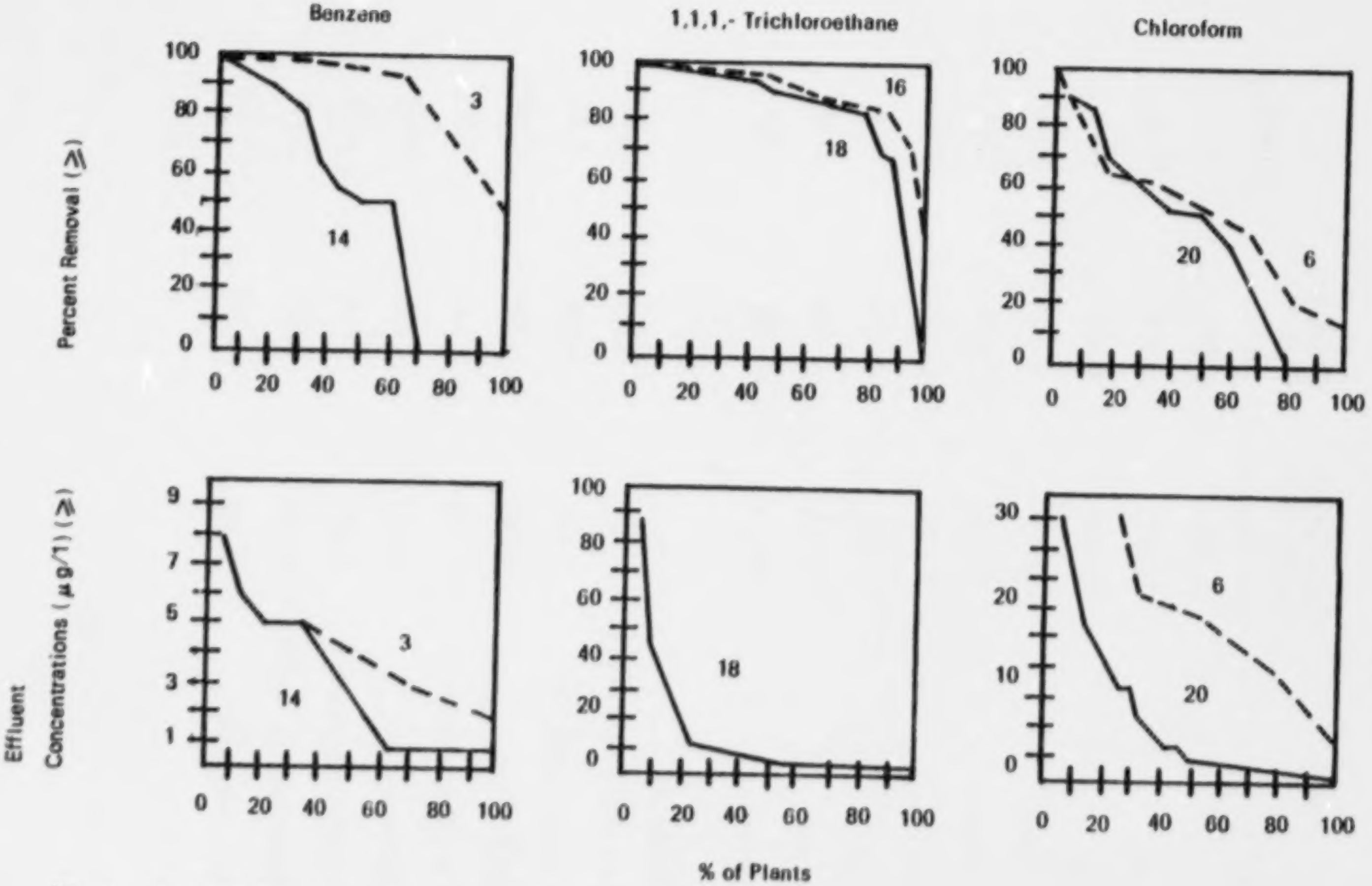
CORRELATION OF INFLUENT AND EFFLUENT CONCENTRATION

Metals	Correlation Coefficient (R)	Slope of Best Fit Line	Intercept
Cadmium	0.995	0.058	2.7
Nickel	0.915	0.515	16.2
Zinc	0.834	0.105	52.1
Copper	0.657	0.074	17.3
Cyanide	0.633	0.225	113
Chromium	0.573	0.040	22.3
Lead	0.509	0.175	24.9
Silver	0.204	0.048	2.46
Mercury	-0.13	-0.062	459
Volatiles			
Tetrachloroethylene	0.937	0.317	-3.91
Trichloroethylene	0.891	0.099	2.23
Chloroform	0.886	0.529	0.64
Trichloroethane	0.778	0.157	0.27
Toluene	0.749	0.804	-20.5
Dichloroethylene	0.616	0.148	2.29
Methylene Chloride	0.324	0.072	33.4
Ethylbenzene	0.262	0.033	1.88

APPENDIX A

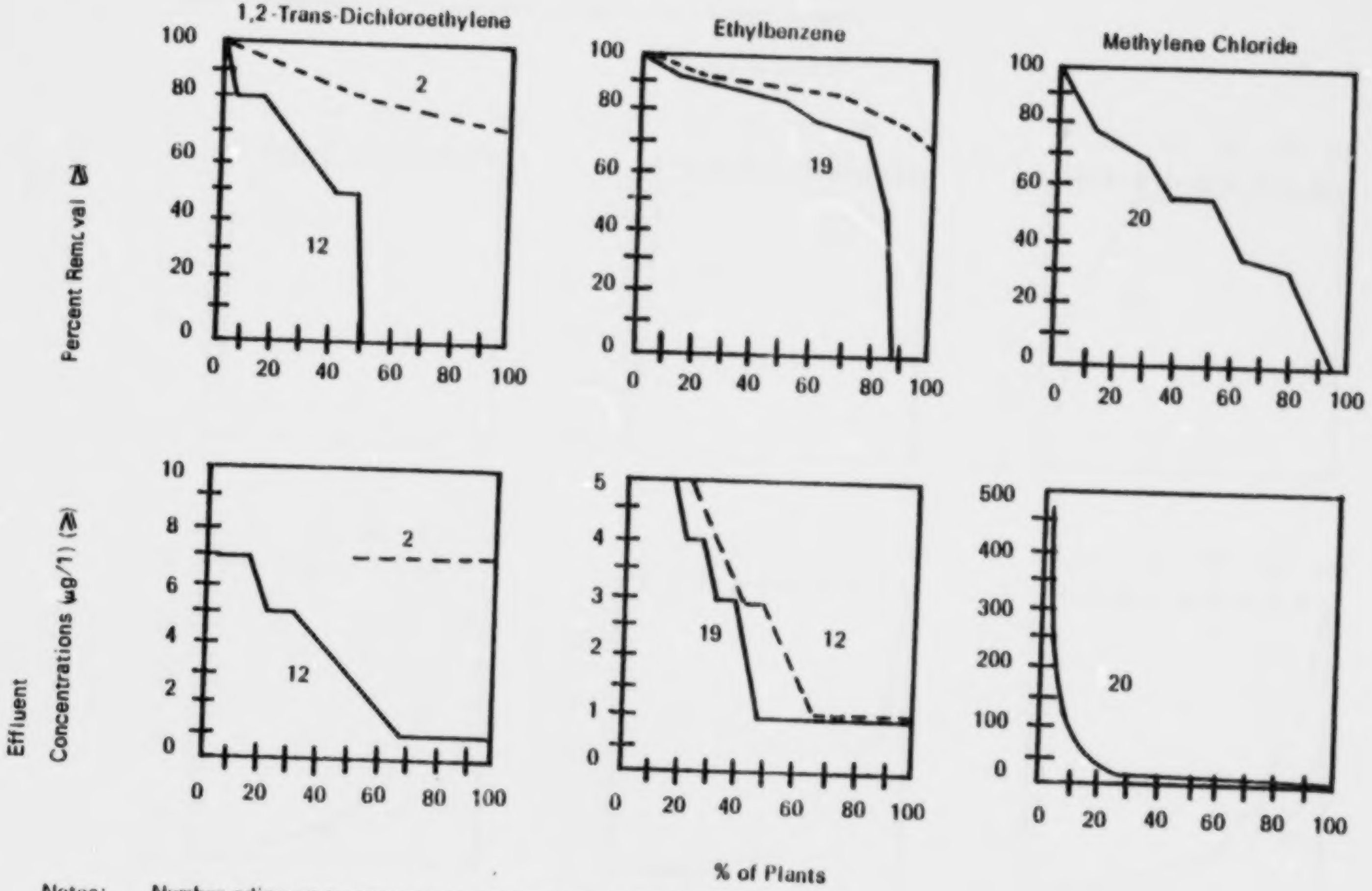
CUMULATIVE DISTRIBUTION CURVES

FIGURE A-1



Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations >0.
When two curves are presented, dashed line - Plants with influent average concentration >10.

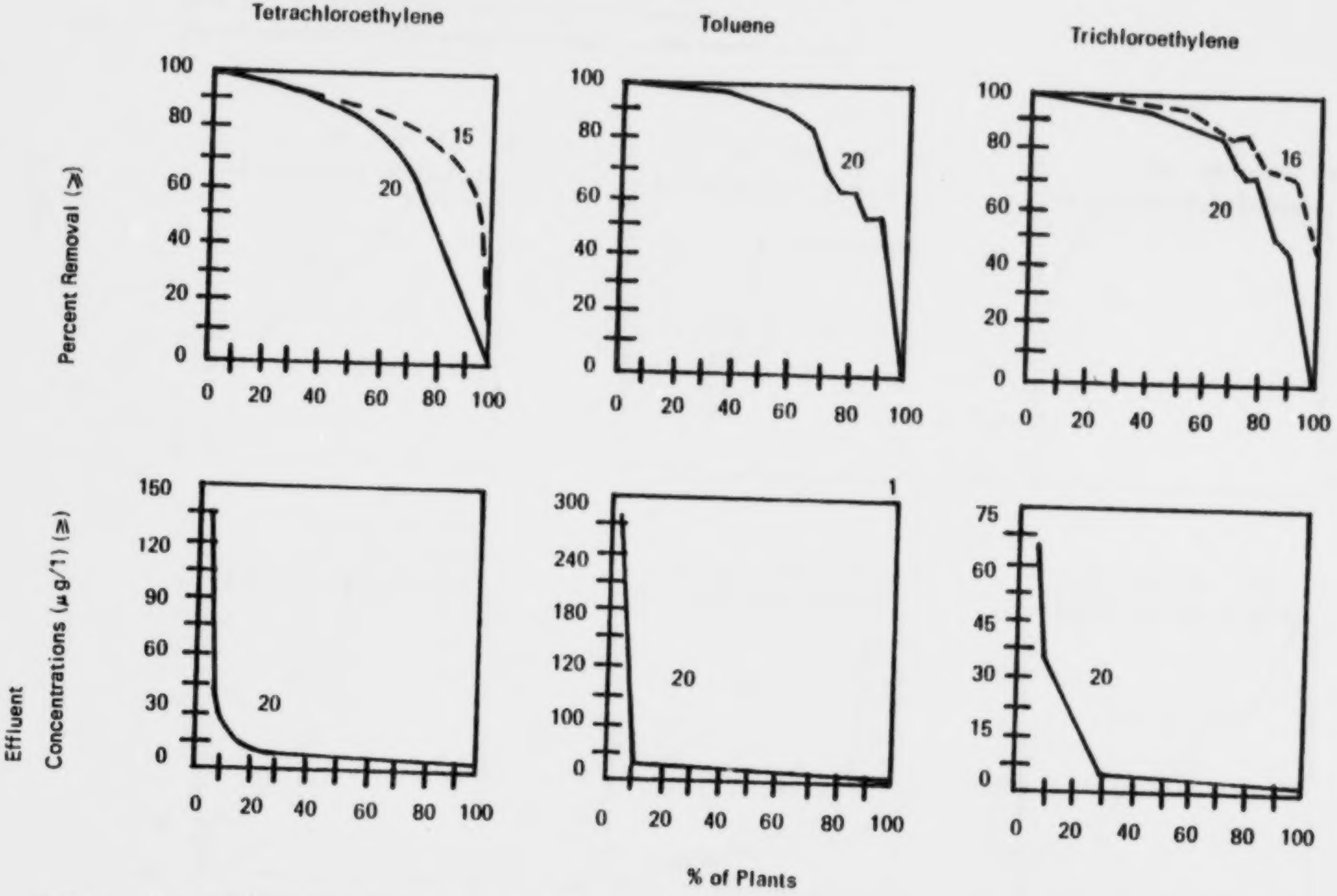
FIGURE A-2



Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations>0.
When two curves are presented, dashed line - Plants with influent average concentration>10.

107<

FIGURE A-3



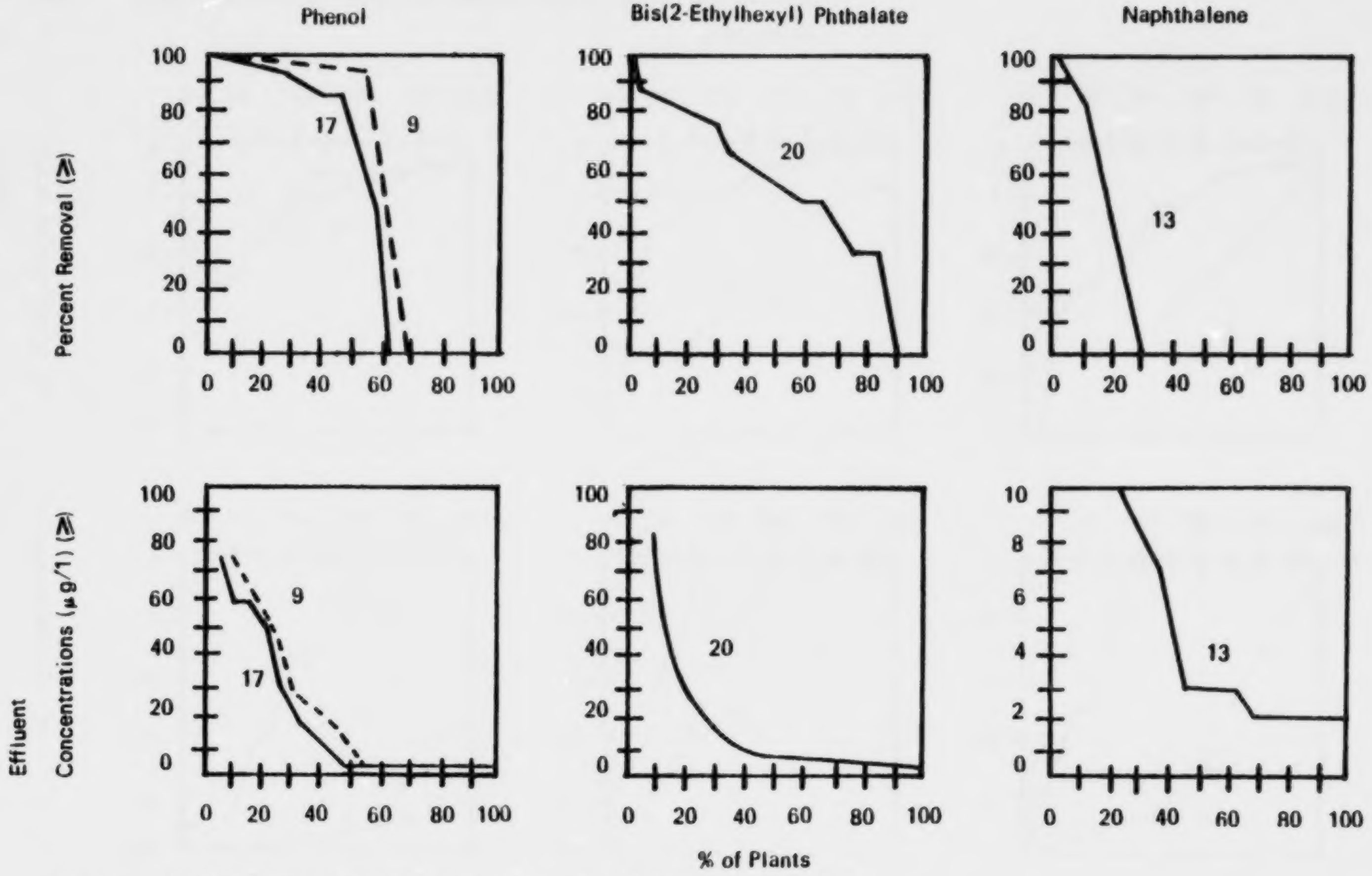
Tetrachloroethylene

Toluene

Trichloroethylene

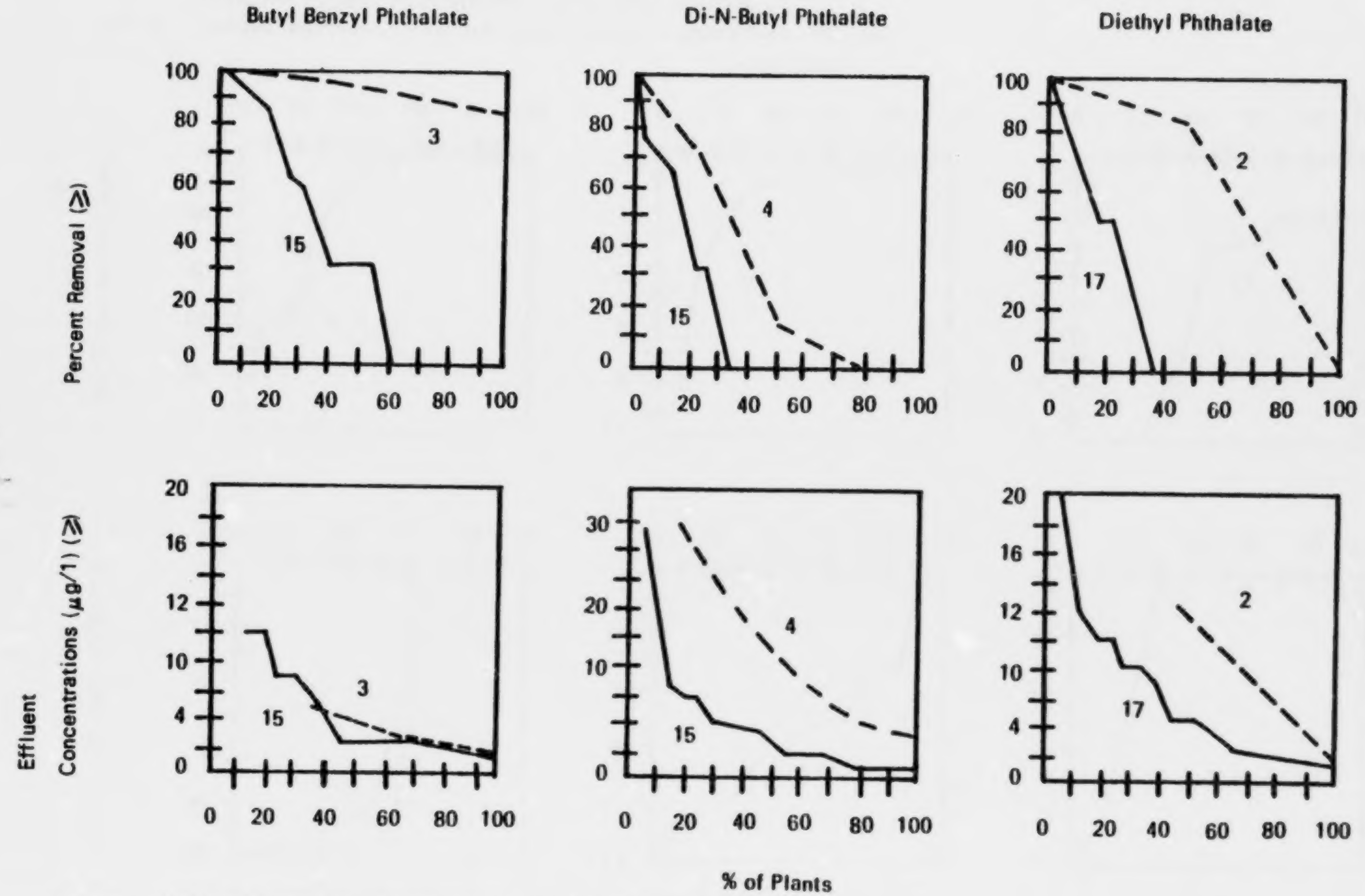
Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations >0.
When two curves are presented, dashed line - Plants with influent average concentration >10.

FIGURE A-4



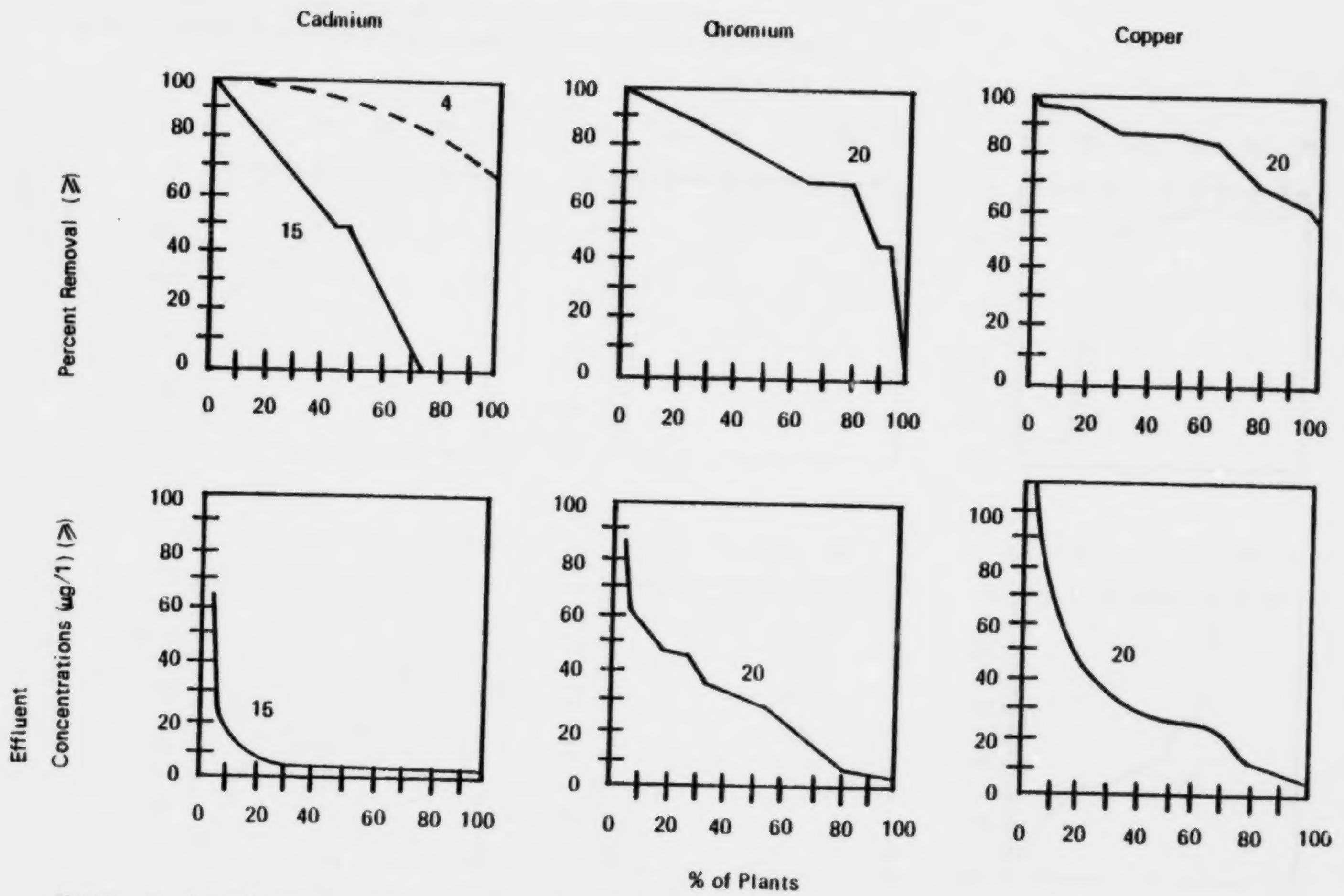
Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations>0.
When two curves are presented, dashed line - Plants with influent average concentration >10.

FIGURE A-5



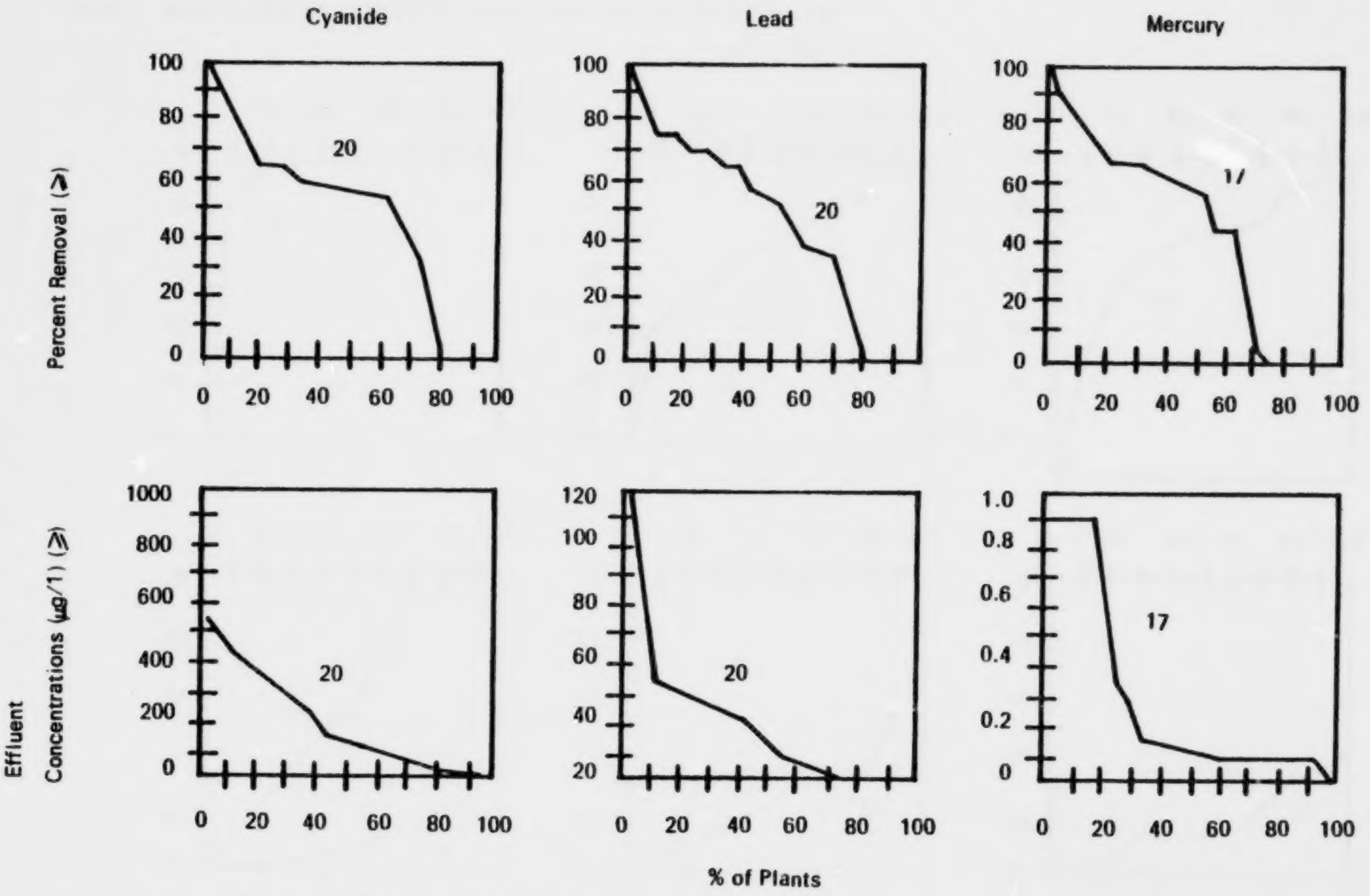
Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations >0.
When two curves are presented, dashed line - Plants with influent average concentration > 10.

FIGURE A-6



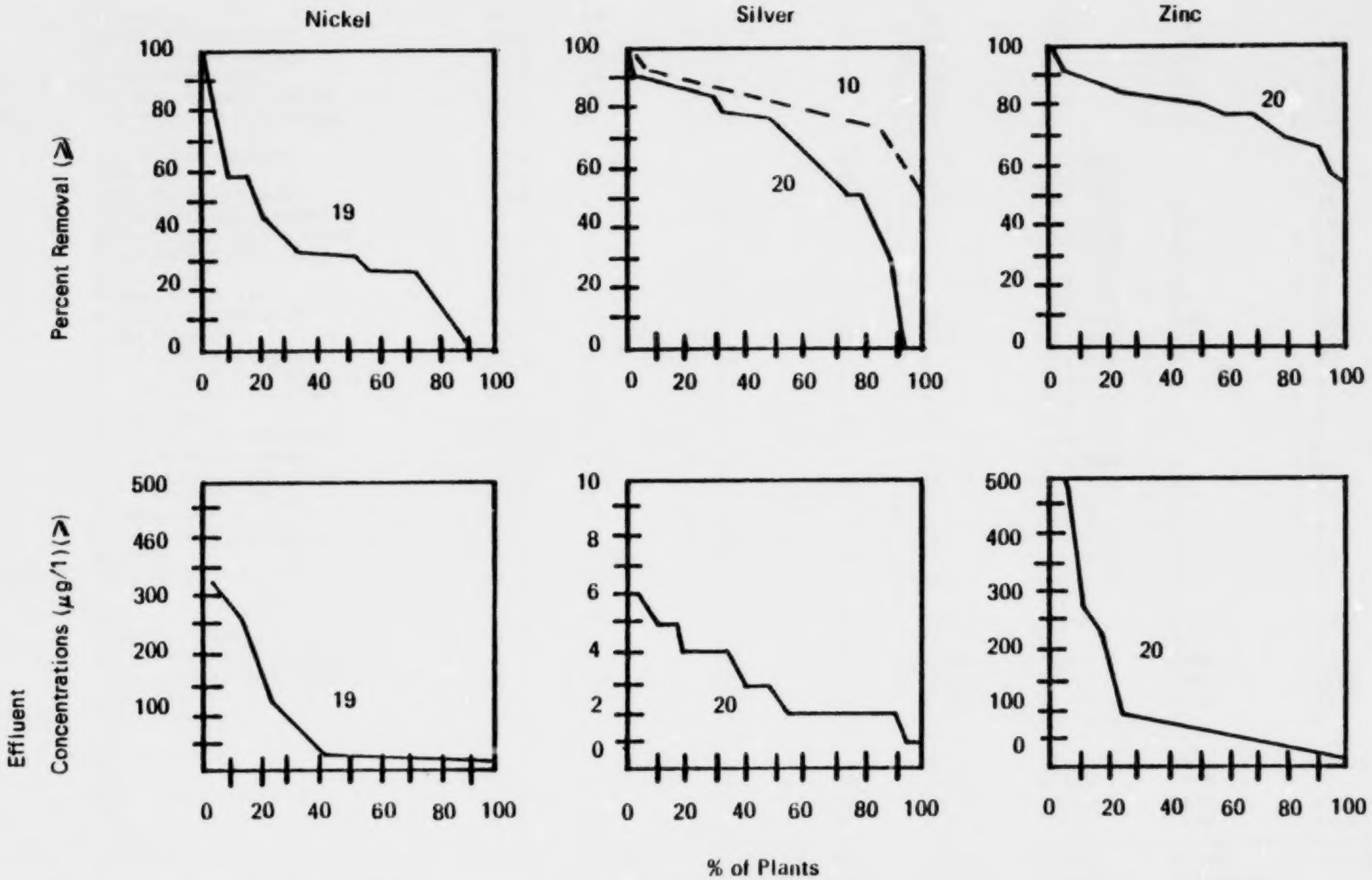
Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations > 0.
When two curves are presented, dashed line - Plants with influent average concentration >10.

FIGURE A-7



Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations>0.
When two curves are presented, dashed line - Plants with influent average concentration ≥10.

FIGURE A-8



Notes: Number adjacent to curve represents number of data points included.
Solid line - Plants with influent average concentrations >0.
When two curves are presented, dashed line - Plants with influent average concentration >10.

APPENDIX B

ANALYTICAL DATA RESULTS

SUMMARY OF ANALYTICAL DATA

PLANT 1

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	SECONDARY SLUDGE	FLOTABLES
CONV.	BOD	MG/L	215	13	94	20167	6667	6880	1900
	TOTAL SUSP. SOLIDS	MG/L	175	20	89	46667	17500	6740	3255
	COD	MG/L	423	66	84	57500	18417	6640	7650
	OIL & GREASE	MG/L	50	5	90	8860	NOT RUN	389	15856
NON-CONV.	TOTAL PHENOLS	UG/L	150	13	91	672	NOT RUN	35	82
	TOTAL SOLIDS	MG/L	939	834	11	56667	19300	6200	11057
	TOTAL VOLATILE SOLIDS	MG/L	252	262		26833	9667	3380	9165
	TOTAL VOL. SUS. SOLIDS	MG/L	113	14	38	23333	7800	4500	2962
	AMMONIA NITROGEN	MG/L	7	5	29	59	23	9	6
	TOC	MG/L	205	65	68	23500	8183	2820	2250
VOLATILES	ACRYLONITRILE	UG/L	L 100	L 100		L 100	NOT RUN	3	2
	BENZENE	UG/L	143	3	98	171	NOT RUN	9	42
	CARBON TETRACHLORIDE	UG/L	1	L 5		11	NOT RUN	7	7
	CHLOROBENZENE	UG/L	1	L 5		L 5	NOT RUN	L 5	L 5
	1,2-DICHLOROETHANE	UG/L	0	L 5		L 5	NOT RUN	L 5	L 5
	1,1,1-TRICHLOROETHANE	UG/L	16	3	83	24	NOT RUN	L 5	2
	1,1-DICHLOROETHANE	UG/L	1	L 5		11	NOT RUN	L 5	L 5
	1,1,2-TRICHLOROETHANE	UG/L	5	L 5		L 5	NOT RUN	L 5	L 5
	CHLOROFORM	UG/L	46	19	59	L 35	NOT RUN	L 5	L 5
	1,1-DICHLOROETHYLENE	UG/L	4	4		9	NOT RUN	L 5	L 5
	1,2-TRANS-DICHLOROETHYLENE	UG/L	6	1	83	23	NOT RUN	L 5	4
	1,2-DICHLOROPROPANE	UG/L	0	L 5		L 5	NOT RUN	L 5	L 5
	ETHYLBENZENE	UG/L	26	4	86	276	NOT RUN	4	51
	METHYLENE CHLORIDE	UG/L	12	6	50	222	NOT RUN	250	243
	METHYL CHLORIDE	UG/L	0	L 5		L 5	NOT RUN	L 5	L 5
	BROMOFORM	UG/L	0	L 5		L 5	NOT RUN	L 5	L 5
	DICHLOROBROMOMETHANE	UG/L	0	1		57	NOT RUN	52	61
	TRICHLOROFLUOROMETHANE	UG/L	0	0		L 5	NOT RUN	L 5	L 5
	CHLORODIBROMOMETHANE	UG/L	0	L 5		17	NOT RUN	34	25
	TETRACHLOROETHYLENE	UG/L	51	5	90	293	NOT RUN	8	72
	TOLUENE	UG/L	26	4	86	284	NOT RUN	3	79
	TRICHLOROETHYLENE	UG/L	28	4	86	264	NOT RUN	6	23
ACIDS.	2,4,6-TRICHLOROPHENOL	UG/L	0	L 50		L 50	L 50	L 50	L 50
	PARACHLOROMETA CRESOL	UG/L	0	L 50		L 50	L 50	L 50	L 50
	2-CHLOROPHENOL	UG/L	L 50	1		L 50	L 50	L 50	L 50
	2,4-DIMETHYLPHENOL	UG/L	L 50	1		L 50	L 50	L 50	L 50
	PENTACHLOROPHENOL	UG/L	1	1		93	15	112	230
	PHENOL	UG/L	16	21		94	33	68	7

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 1

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	SECONDARY SLUDGE	FLOTABLES
BASE-NEUT.	ACENAPHTHENE	UG/L	0	L 10		117	75	L 10	189
	1,2,4-TRICHLOROBENZENE	UG/L	0	L 10		L 10	L 10	L 10	L 10
	HEXACHLOROBENZENE	UG/L	0	L 10		L 10	L 10	L 10	L 10
	1,2-DICHLOROBENZENE	UG/L	3	1	67	L 10	L 10	L 10	L 10
	1,3-DICHLOROBENZENE	UG/L	1	1		L 10	L 10	L 10	L 10
	1,4-DICHLOROBENZENE	UG/L	3	1	67	L 10	L 10	L 10	L 10
	3,3'-DICHLOROBENZIDINE	UG/L	L 25	1		L 25	L 25	L 25	L 25
	FLUORANTHENE	UG/L	1	2		L 10	L 10	L 10	L 10
	BIS(2-CHLOROETHYOXY) METHANE	UG/L	0	L 25		L 25	L 25	L 25	L 25
	HEXACHLOROBUTADIENE	UG/L	0	L 10		L 10	L 10	L 10	L 10
	NAPHTHALENE	UG/L	4	2	50	195	23	4	421
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	27	14	48	2231	1240	42	511
	BUTYL BENZYL PHTHALATE	UG/L	2	2		1	L 10	L 10	100
	DI-N-BUTYL PHTHALATE	UG/L	5	3	40	L 10	L 10	L 10	5
	DI-N-OCTYL PHTHALATE	UG/L	0	1		L 10	L 10	L 10	L 10
	DIETHYL PHTHALATE	UG/L	3	1	67	L 10	L 10	L 10	L 10
	DIMETHYL PHTHALATE	UG/L	2	1	50	L 10	L 10	L 10	L 10
	1,2-BENZANTHRACENE	UG/L	1	1		479	250	L 10	186
	BENZO (A)PYRENE	UG/L	0	L 10		L 10	L 10	L 10	L 10
	3,4-BENZOFLUORANTHENE	UG/L	L 5	L 5		675	299	0	137
	CHRYSENE	UG/L	1	1		479	250	L 10	186
	ACENAPHTHYLENE	UG/L	0	L 10		L 10	L 10	L 10	L 10
	ANTHRACENE	UG/L	4	2	50	1572	842	4	1118
	1,12-BENZOPERYLENE	UG/L	0	L 25		L 25	L 25	L 25	L 25
	FLUORENE	UG/L	1	1		313	133	L 10	2
	PHENANTHRENE	UG/L	4	2	50	1572	842	4	1118
	1,2:5,6-DIBENZANTHRACENE	UG/L	0	1		L 50	L 50	10	L 50
	INDENO(1,2,3-C,D) PYRENE	UG/L	0	1		L 50	L 50	8	L 50
	PYRENE	UG/L	5	3	40	754	349	L 10	192
METALS	ANTIMONY	UG/L	L 50	L 50		146	66	25	4
	ARSENIC	UG/L	L 50	L 50		1263	176	67	23
	BERYLLIUM	UG/L	L 2	L 2		37	12	10	1
	CADMIUM	UG/L	12	4	67	1220	599	322	32
	CHROMIUM	UG/L	450	46	90	14571	17686	19917	4436
	COPPER	UG/L	191	27	86	77429	24243	8917	1686
	CYANIDE	UG/L	71	7	90	627	NOT RUN	59	L 58
	LEAD	UG/L	55	L 20	64	46857	11029	1798	112
	MERCURY	NG/L	276	400		1000	714	333	266
	NICKEL	UG/L	96	40	59	13343	3186	3700	411
	SELENIUM	UG/L	L 50	L 50		5	5	22	3

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 1

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	SECONDARY SLUDGE	FLOTABLES
METALS	SILVER	UG/L	8	L 2	75	25	92	207	19
	THALLIUM	UG/L	L 56	L 50		2	1	1	2
	ZINC	UG/L	264	90	66	129714	47857	14717	2450
N-C METALS	ALUMINUM	UG/L	1456	203	86	NOT RUN	NOT RUN	NOT RUN	NOT RUN
	BARIUM	UG/L	129	50	61	NOT RUN	NOT RUN	NOT RUN	NOT RUN
	CALCIUM	MG/L	83	79	5	NOT RUN	NOT RUN	NOT RUN	NOT RUN
	IRON	UG/L	2990	392	87	NOT RUN	NOT RUN	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	27	27		NOT RUN	NOT RUN	NOT RUN	NOT RUN
	MANGANESE	UG/L	104	111		NOT RUN	NOT RUN	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY
WEEK 1 DATA ONLY

PLANT 1

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	152859	137770	10135	53756	73879
	TOTAL SUSP. SOLIDS	106606	216615	15076	124395	77144
	COD	308046	287206	51688	153272	82246
	OIL & GREASE	39634	32088	3909	23617	4562
NON-CONVENTIONALS	TOTAL PHENOLS	130	12.3	10.1	1.8	.4
	TOTAL SOLIDS	707285	858569	633680	151051	73838
	TOTAL VOLATILE SOLIDS	176232	310750	198896	71527	40327
	TOTAL VOL. SUS. SOLIDS	79660	124141	10515	62197	51429
	AMMONIA NITROGEN	4751	4063	3801	156	106
	TOC	193449	145442	49534	62642	33266
VOLATILES	ACRYLONITRILE	N-D	L 0.1	N-D	N-D	L 0.1
	BENZENE	6.9	2.6	2.0	.5	.1
	CARBON TETRACHLORIDE	1.0	L 0.1	N-D	L 0.1	L 0.1
	CHLOROBENZENE	.6	N-D	N-D	N-D	N-D
	1,2-DICHLOROETHANE	.1	N-D	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	14.0	2.7	2.6	L 0.1	N-D
	1,1-DICHLOROETHANE	.8	N-D	N-D	L 0.1	N-D
	1,1,2-TRICHLOROETHANE	5.1	N-D	N-D	N-D	N-D
	CHLOROFORM	37.5	14.3	14.3	N-D	N-D
	1,1-DICHLOROETHYLENE	3.4	2.8	2.8	L 0.1	N-D
	1,2-TRANS-DICHLOROETHYLENE	3.2	.8	.7	L 0.1	N-D
	1,2-DICHLOROPROPANE	.1	N-D	N-D	N-D	N-D
	ETHYLBENZENE	24.7	3.5	2.8	.7	L 0.1
	METHYLENE CHLORIDE	8.0	8.1	4.5	.6	3.0
	METHYL CHLORIDE	.2	N-D	N-D	N-D	N-D
	DICHLOROBROMOMETHANE	.1	1.8	.9	.2	.7
	TRICHLOROFLUOROMETHANE	.1	.2	.2	N-D	N-D
	CHLORODIBROMOMETHANE	N-D	.4	N-D	L 0.1	.4
	TETRACHLOROETHYLENE	41.4	4.8	3.9	.8	L 0.1
	TOLUENE	15.6	4.2	3.4	.8	L 0.1
	TRICHLOROETHYLENE	19.8	4.1	3.3	.8	L 0.1
ACID EXTRACT	2,4,6-TRICHLOROPHENOL	.2	N-D	N-D	N-D	N-D
	PARACHLOROMETA CRESOL	.2	N-D	N-D	N-D	N-D
	2-CHLOROPHENOL	N-D	.5	.5	N-D	N-D
	2,4-DIMETHYLPHENOL	N-D	.5	.5	N-D	N-D
	PENTACHLOROPHENOL	1.3	2.1	.5	.2	1.4
	PHENOL	12.1	16.7	15.6	.3	.8
BASE-NEUTRALS	ACENAPHTHENE	.4	N-D	N-D	.3	N-D
	1,2,4-TRICHLOROBENZENE	.2	N-D	N-D	N-D	N-D
	HEXACHLOROBENZENE	.2	N-D	N-D	N-D	N-D
	1,2-DICHLOROBENZENE	1.6	.5	.5	N-D	N-D
	1,3-DICHLOROBENZENE	.9	.5	.5	N-D	N-D
	1,4-DICHLOROBENZENE	1.4	1.1	1.1	N-D	N-D
	3,3'-DICHLOROBENZIDINE	N-D	.5	.5	N-D	N-D
	FLUORANTHENE	1.1	1.6	1.6	N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY
WEEK 1 DATA ONLY

PLANT 1

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	BIS(2-CHLOROETHYOXY) METHANE	.4	N-D	N-D	N-D	N-D
	HEXACHLOROBUTADIENE	.2	N-D	N-D	N-D	N-D
	NAPHTHALENE	3.2	2.1	1.6	.5	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	25.7	16.7	10.3	5.9	.5
	BUTYL BENZYL PHTHALATE	1.7	1.6	1.6	L 0.1	N-D
	DI-N-BUTYL PHTHALATE	4.3	2.2	2.2	N-D	N-D
	DI-N-OCTYL PHTHALATE	.2	.5	.5	N-D	N-D
	DIETHYL PHTHALATE	2.4	1.1	1.1	N-D	N-D
	DIMETHYL PHTHALATE	1.4	.5	.5	N-D	N-D
	1,2-BENZANTHRACENE	.4	1.8	.5	1.3	N-D
	3,4-BENZOFLUORANTHENE	N-D	L 0.1	N-D	1.8	L 0.1
	CHRYSENE	.4	1.8	.5	1.3	N-D
	ACENAPHTHYLENE	.2	N-D	N-D	N-D	N-D
	ANTHRACENE	2.7	5.9	1.6	4.2	L 0.1
	1,12-BENZOPERYLENE	.2	N-D	N-D	N-D	N-D
	FLUORENE	1.1	1.3	.5	.8	N-D
	PHENANTHRENE	2.7	5.9	1.6	4.2	L 0.1
	1,2:5,6-DIBENZANTHRACENE	.2	.6	.5	N-D	.1
	INDENO(1,2,3-C,D) PYRENE	.2	.6	.5	N-D	L 0.1
	PYRENE	1.3	4.2	2.2	2.0	N-D
METALS	ANTIMONY	N-D	.7	N-D	.4	.3
	ARSENIC	N-D	4.2	N-D	3.4	.8
	BERYLLIUM	N-D	.2	N-D	L 0.1	.1
	CADMIUM	8.9	10.6	3.1	3.3	4.2
	CHROMIUM	337	295	35.1	38.8	221
	COPPER	148	337	20.7	206	110
	CYANIDE	12.3	7.4	5.0	1.7	.7
	LEAD	36.7	144.4	N-D	125	19.5
	MERCURY	.2	.3	.3	L 0.1	L 0.1
	NICKEL	74.1	107.2	30.7	35.6	40.9
	SELENIUM	N-D	.3	N-D	L 0.1	.3
	SILVER	5.8	2.3	N-D	L 0.1	2.2
	THALLIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	ZINC	192	572	68.6	346	157
NON-CONV. METALS	ALUMINUM	1030	-	154	NOT RUN	NOT RUN
	BARIUM	96.5	-	37.7	NOT RUN	NOT RUN
	CALCIUM	62329	-	60375	NOT RUN	NOT RUN
	IRON	2437	-	298	NOT RUN	NOT RUN
	MAGNESIUM	20059	-	20197	NOT RUN	NOT RUN
	MANGANESE	76.2	-	84.0	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 1

PARAMETER	INFL-UENT	PRECL EFFL	SEC. EFFL	PRIM. SLDG	COMB SLDG	SEC. SLDG	FLOT-ABLES	TAP WATER
BENZENE	100 (28)	33 (3)	86 (7)	100 (7)	0 ( )	50 (6)	86 (7)	100 (1)
1,1,1-TRICHLOROETHANE	100 (28)	100 (3)	100 (7)	57 (7)	0 ( )	0 (6)	14 (7)	0 (1)
CHLOROFORM	100 (28)	100 (3)	100 (7)	0 (7)	0 ( )	0 (6)	0 (7)	100 (1)
METHYLENE CHLORIDE	100 (28)	100 (3)	100 (7)	100 (7)	0 ( )	100 (6)	100 (7)	100 (1)
TETRACHLOROETHYLENE	100 (28)	100 (3)	100 (7)	100 (7)	0 ( )	83 (6)	71 (7)	100 (1)
TOLUENE	100 (28)	100 (3)	100 (7)	100 (7)	0 ( )	33 (6)	86 (7)	100 (1)
TRICHLOROETHYLENE	100 (28)	100 (3)	100 (7)	100 (7)	0 ( )	17 (6)	71 (7)	0 (1)
CHROMIUM	100 (23)	100 (3)	100 (7)	100 (7)	100 (7)	100 (6)	100 (7)	0 (1)
COPPER	100 (23)	100 (3)	100 (7)	100 (7)	100 (7)	100 (6)	100 (7)	0 (1)
CYANIDE	100 (28)	0 ( )	100 (7)	100 (7)	0 ( )	50 (6)	0 (7)	0 (1)
ZINC	100 (23)	100 (3)	100 (7)	100 (7)	100 (7)	100 (6)	100 (7)	0 (1)
ETHYLBENZENE	96 (28)	0 (3)	100 (7)	100 (7)	0 ( )	33 (6)	86 (7)	0 (1)
NICKEL	96 (23)	100 (3)	100 (7)	100 (7)	100 (7)	100 (6)	100 (7)	100 (1)
1,2-TRANS-DICHLOROETHYLENE	93 (28)	0 (3)	43 (7)	43 (7)	0 ( )	0 (6)	29 (7)	0 (1)
PHENOL	93 (28)	100 (3)	100 (7)	29 (7)	17 (6)	20 (5)	29 (7)	100 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	93 (28)	100 (3)	100 (7)	86 (7)	83 (6)	40 (5)	86 (7)	100 (1)
CADMIUM	91 (23)	67 (3)	71 (7)	100 (7)	100 (7)	100 (6)	100 (7)	100 (1)
1,1-DICHLOROETHYLENE	89 (28)	100 (3)	100 (7)	29 (7)	0 ( )	0 (6)	0 (7)	100 (1)
NAPHTHALENE	82 (28)	0 (3)	43 (7)	71 (7)	50 (6)	20 (5)	57 (7)	0 (1)
SILVER	78 (23)	0 (3)	0 (7)	100 (7)	100 (7)	100 (6)	86 (7)	100 (1)
ANTHRACENE	75 (28)	0 (3)	43 (7)	86 (7)	83 (6)	40 (5)	100 (7)	0 (1)
PHENANTHRENE	75 (28)	0 (3)	43 (7)	86 (7)	83 (6)	40 (5)	100 (7)	0 (1)
MERCURY	74 (23)	33 (3)	100 (7)	29 (7)	29 (7)	17 (6)	14 (7)	100 (1)
LEAD	70 (23)	0 (3)	0 (7)	100 (7)	100 (7)	100 (6)	86 (7)	100 (1)
DI-N-BUTYL PHTHALATE	68 (28)	33 (3)	57 (7)	0 (7)	0 (6)	0 (5)	14 (7)	100 (1)
DIETHYL PHTHALATE	61 (28)	0 (3)	29 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,2-DICHLOROBENZENE	54 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,4-DICHLOROBENZENE	50 (28)	0 (3)	29 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,1-DICHLOROETHANE	43 (28)	0 (3)	0 (7)	57 (7)	0 ( )	0 (6)	0 (7)	0 (1)
BUTYL BENZYL PHTHALATE	39 (28)	0 (3)	43 (7)	14 (7)	0 (6)	0 (5)	43 (7)	0 (1)
DIMETHYL PHTHALATE	39 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
PYRENE	36 (28)	0 (3)	57 (7)	71 (7)	67 (6)	0 (5)	100 (7)	0 (1)
CHLOROBENZENE	29 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
PENTACHLOROPHENOL	29 (28)	67 (3)	14 (7)	14 (7)	17 (6)	20 (5)	29 (7)	0 (1)
FLUORANTHENE	29 (28)	0 (3)	43 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
FLUORENE	29 (28)	0 (3)	14 (7)	43 (7)	33 (6)	0 (5)	14 (7)	0 (1)
1,3-DICHLOROBENZENE	21 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
CARBON TETRACHLORIDE	18 (28)	0 (3)	0 (7)	29 (7)	0 ( )	33 (6)	29 (7)	100 (1)
1,2-BENZANTHRACENE	18 (28)	0 (3)	14 (7)	86 (7)	67 (6)	0 (5)	86 (7)	0 (1)
CHRYSENE	18 (28)	0 (3)	14 (7)	86 (7)	67 (6)	0 (5)	86 (7)	0 (1)
1,1,2-TRICHLOROETHANE	11 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
METHYL CHLORIDE	7 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
TRICHLOROFLUOROMETHANE	7 (28)	0 (3)	14 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
ACENAPHTHENE	7 (28)	0 (3)	0 (7)	57 (7)	50 (6)	0 (5)	43 (7)	0 (1)
BIS(2-CHLOROETHYOXY) METHANE	7 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,2:5,6-DIBENZANTHRACENE	7 (28)	0 (3)	14 (7)	0 (7)	0 (6)	20 (5)	0 (7)	0 (1)
INDENO(1,2,3-C,D) PYRENE	7 (28)	0 (3)	14 (7)	0 (7)	0 (6)	20 (5)	0 (7)	0 (1)
1,2-DICHLOROETHANE	4 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
1,2-DICHLOROPROPANE	4 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
BROMOFORM	4 (28)	0 (3)	0 (7)	0 (7)	0 ( )	0 (6)	0 (7)	0 (1)
DICHLOROBROMOMETHANE	4 (28)	0 (3)	57 (7)	100 (7)	0 ( )	83 (6)	86 (7)	100 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 1

PARAMETER	INFL-UENT	PRECL EFFL	SEC. EFFL	PRIM. SLDG	COMB SLDG	SEC. SLDG	FLOT-ABLES	TAP WATER
CHLORODIBROMOMETHANE	4 (28)	0 (3)	0 (7)	43 (7)	0 ( )	67 (6)	71 (7)	0 (1)
2,4,6-TRICHLOROPHENOL	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
PARACHLOROMETA CRESOL	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,2,4-TRICHLOROBENZENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
HEXACHLOROBENZENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
HEXACHLOROBUTADIENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
DI-N-OCTYL PHTHALATE	4 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
BENZO (A)PYRENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
ACENAPHTHYLENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
1,12-BENZOPERYLENE	4 (28)	0 (3)	0 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
ACRYLONITRILE	0 (28)	0 (3)	0 (7)	0 (7)	0 ( )	17 (6)	14 (7)	0 (1)
2-CHLOROPHENOL	0 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
2,4-DIMETHYLPHENOL	0 (28)	33 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
3,3'-DICHLOROBENZIDINE	0 (28)	0 (3)	14 (7)	0 (7)	0 (6)	0 (5)	0 (7)	0 (1)
3,4-BENZOFLUORANTHENE	0 (28)	0 (3)	0 (7)	71 (7)	50 (6)	20 (5)	86 (7)	0 (1)
ANTIMONY	0 (23)	0 (3)	0 (7)	100 (7)	100 (7)	100 (6)	29 (7)	100 (1)
ARSENIC	0 (23)	0 (3)	0 (7)	100 (7)	100 (7)	100 (6)	43 (7)	0 (1)
BERYLLIUM	0 (23)	0 (3)	0 (7)	100 (7)	100 (7)	100 (6)	100 (7)	0 (1)
SELENIUM	0 (23)	0 (3)	0 (7)	43 (7)	29 (7)	83 (6)	29 (7)	0 (1)
THALLIUM	0 (23)	0 (3)	0 (7)	100 (7)	43 (7)	83 (6)	86 (7)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 2

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	COMBINED SLUDGE
CONVENTIONALS	BOD	MG/L	95	14	85	20	8457
	TOTAL SUSP. SOLIDS	MG/L	97	9	91	12	21714
	COD	MG/L	183	36	79	52	32427
	OIL & GREASE	MG/L	24	6	67	NOT RUN	3551
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	20	3	85	NOT RUN	454
	TOTAL SOLIDS	MG/L	619	567	8	496	25571
	TOTAL VOLATILE SOLIDS	MG/L	143	132	8	129	14266
	TOTAL VOL. SUS. SOLIDS	MG/L	54	6	89	7	12100
	AMMONIA NITROGEN	MG/L	1.	71		70	12707
	TOC	MG/L	70	26	63	29	11729
VOLATILES	ACRYLONITRILE	UG/L	L 100	L 100		L 100	41
	BENZENE	UG/L	10	3	70	1	33
	CHLOROBENZENE	UG/L	6	L 5		0	L 5
	1,2-DICHLOROETHANE	UG/L	1	1		1	L 5
	1,1,1-TRICHLOROETHANE	UG/L	1	0	100	6	L 5
	1,1-DICHLOROETHANE	UG/L	0	L 5		L 5	L 5
	CHLOROFORM	UG/L	5	5		4	L 5
	1,1-DICHLOROETHYLENE	UG/L	2	2		1	L 5
	1,2-DICHLOROPROPANE	UG/L	0	L 5		L 5	L 5
	ETHYLBENZENE	UG/L	2	0	100	0	2
	METHYLENE CHLORIDE	UG/L	9	4	56	4	247
	DICHLOROBROMOMETHANE	UG/L	1	2		1	74
	TRICHLOROFLUOROMETHANE	UG/L	L 5	L 5		0	L 5
	CHLORODIBROMOMETHANE	UG/L	0	1		1	9
	TETRACHLOROETHYLENE	UG/L	5	3	40	3	61
	TOLUENE	UG/L	5	3	40	3	330
	TRICHLOROETHYLENE	UG/L	2	0	100	0	L 5
ACID EXTRACT	2-NITROPHENOL	UG/L	L 50	2		5	L 50
	4-NITROPHENOL	UG/L	L 50	15		33	L 50
	PENTACHLOROPHENOL	UG/L	1	1		2	L 50
	PHENOL	UG/L	4	4		4	4
BASE-NEUTRALS	1,2-DICHLOROBENZENE	UG/L	4	1	75	1	L 10
	1,3-DICHLOROBENZENE	UG/L	1	3		1	L 10
	1,4-DICHLOROBENZENE	UG/L	1	L 10		L 10	L 10
	3,3'-DICHLOROBENZIDINE	UG/L	L 25	1		L 25	L 25
	2,6-DINITROTOLUENE	UG/L	1	L 25		L 25	L 25
	FLUORANTHENE	UG/L	2	10		L 10	L 10

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 2

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	COMBINED SLUDGE
BASE-NEUTRALS	ISOPHORONE	UG/L	1	L 25		L 25	L 25
	NAPHTHALENE	UG/L	4	1	75	1	91
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	10	4	60	5	1486
	BUTYL BENZYL PHTHALATE	UG/L	5	4	20	3	1
	DI-N-BUTYL PHTHALATE	UG/L	4	3	25	3	L 10
	DI-N-OCTYL PHTHALATE	UG/L	3	1	67	1	L 10
	DIETHYL PHTHALATE	UG/L	4	1	75	1	L 10
	DIMETHYL PHTHALATE	UG/L	2	1	50	1	L 10
	1,2-BENZANTHRACENE	UG/L	L 10	1		1	8
	BENZO (A)PYRENE	UG/L	1	L 10		L 10	L 10
	3,4-BENZOFLUORANTHENE	UG/L	1	L 5		L 5	43
	11,12-BENZOFLUORANTHENE	UG/L	1	L 5		L 5	L 5
	CHRYSENE	UG/L	L 10	1		1	8
	ACENAPHTHYLENE	UG/L	L 10	1		1	L 10
	ANTHRACENE	UG/L	1	L 10		L 10	91
	PHENANTHRENE	UG/L	1	L 10		L 10	91
	PYRENE	UG/L	2	L 10		L 10	45
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	39
	ARSENIC	UG/L	L 50	L 50		L 50	149
	BERYLLIUM	UG/L	L 2	L 2		L 2	12
	CADMIUM	UG/L	4	L 2	50	L 2	305
	CHROMIUM	UG/L	71	22	69	26	8114
	COPPER	UG/L	54	10	81	11	10700
	CYANIDE	UG/L	77	142		NOT RUN	1788
	LEAD	UG/L	16	3	81	6	7386
	MERCURY	NG/L	214	57	73	33	3286
	NICKEL	UG/L	30	20	33	22	3097
	SELENIUM	UG/L	L 50	L 50		L 50	27
	SILVER	UG/L	1	0	100	5	78
	THALLIUM	UG/L	L 50	L 50		L 50	1
	ZINC	UG/L	278	52	81	83	26743
NON-CONV. METALS	ALUMINUM	UG/L	537	51	91	74	NOT RUN
	BARIUM	UG/L	74	25	66	26	NOT RUN
	CALCIUM	MG/L	58	65		64	NOT RUN
	IRON	UG/L	1640	188	89	198	NOT RUN
	MAGNESIUM	MG/L	12	12		14	NOT RUN
	MANGANESE	UG/L	280	175	38	194	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 2

PARAMETER	INFL-UENT	PRE CL EFFL.	SEC. EFFL	COMB. SLDG	SEC. SLDG	DAF. SLDG	TAP WATER
BENZENE	100 (7)	43 (7)	57 (7)	86 (7)	100 (1)	100 (1)	0 (1)
CHLOROFORM	100 (7)	86 (7)	100 (7)	0 (7)	0 (1)	0 (1)	100 (1)
ETHYLBENZENE	100 (7)	29 (7)	29 (7)	29 (7)	100 (1)	100 (1)	0 (1)
METHYLENE CHLORIDE	100 (7)	100 (7)	86 (7)	100 (7)	100 (1)	100 (1)	100 (1)
TETRACHLOROETHYLENE	100 (7)	86 (7)	100 (7)	86 (7)	0 (1)	100 (1)	0 (1)
TOLUENE	100 (7)	100 (7)	100 (7)	86 (7)	100 (1)	100 (1)	100 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (7)	86 (7)	86 (7)	100 (7)	0 ( )	0 ( )	100 (1)
BUTYL BENZYL PHTHALATE	100 (7)	43 (7)	57 (7)	14 (7)	0 ( )	0 ( )	100 (1)
CHROMIUM	100 (7)	100 (6)	100 (7)	100 (7)	0 ( )	0 ( )	0 (1)
COPPER	100 (7)	100 (6)	100 (7)	100 (7)	0 ( )	0 ( )	100 (1)
CYANIDE	100 (7)	0 ( )	100 (7)	100 (7)	100 (1)	100 (1)	0 (1)
NICKEL	100 (7)	100 (6)	100 (7)	100 (7)	0 ( )	0 ( )	0 (1)
ZINC	100 (7)	100 (6)	100 (7)	86 (7)	0 ( )	0 ( )	100 (1)
1,1,1-TRICHLOROETHANE	86 (7)	14 (7)	14 (7)	0 (7)	0 (1)	0 (1)	0 (1)
TRICHLOROETHYLENE	86 (7)	43 (7)	14 (7)	0 (7)	0 (1)	0 (1)	0 (1)
DI-N-BUTYL PHTHALATE	86 (7)	57 (7)	57 (7)	0 (7)	0 ( )	0 ( )	100 (1)
DIETHYL PHTHALATE	86 (7)	29 (7)	29 (7)	0 (7)	0 ( )	0 ( )	100 (1)
CADMIUM	86 (7)	0 (6)	0 (7)	100 (7)	0 ( )	0 ( )	0 (1)
PHENOL	71 (7)	100 (7)	86 (7)	14 (7)	0 ( )	0 ( )	100 (1)
1,2-DICHLOROBENZENE	71 (7)	14 (7)	29 (7)	0 (7)	0 ( )	0 ( )	100 (1)
NAPHTHALENE	71 (7)	14 (7)	29 (7)	43 (7)	0 ( )	0 ( )	0 (1)
MERCURY	71 (7)	17 (6)	29 (7)	29 (7)	0 ( )	0 ( )	0 (1)
1,1-DICHLOROETHYLENE	57 (7)	43 (7)	57 (7)	0 (7)	0 (1)	0 (1)	0 (1)
DICHLOROBROMOMETHANE	57 (7)	57 (7)	86 (7)	100 (7)	100 (1)	100 (1)	0 (1)
DI-N-OCTYL PHTHALATE	57 (7)	29 (7)	14 (7)	0 (7)	0 ( )	0 ( )	0 (1)
1,2-DICHLOROETHANE	43 (7)	29 (7)	29 (7)	0 (7)	0 (1)	0 (1)	0 (1)
FLUORANTHENE	43 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
DIMETHYL PHTHALATE	43 (7)	29 (7)	29 (7)	0 (7)	0 ( )	0 ( )	0 (1)
PYRENE	43 (7)	0 (7)	0 (7)	71 (7)	0 ( )	0 ( )	0 (1)
CHLOROBENZENE	29 (7)	14 (7)	0 (7)	0 (7)	0 (1)	0 (1)	0 (1)
1,1-DICHLOROETHANE	29 (7)	0 (7)	0 (7)	0 (7)	0 (1)	0 (1)	0 (1)
CHLORODIBROMOMETHANE	29 (7)	43 (7)	57 (7)	29 (7)	0 (1)	0 (1)	100 (1)
ANTHRACENE	29 (7)	0 (7)	0 (7)	71 (7)	0 ( )	0 ( )	0 (1)
PHENANTHRENE	29 (7)	0 (7)	0 (7)	71 (7)	0 ( )	0 ( )	0 (1)
LEAD	29 (7)	17 (6)	14 (7)	100 (7)	0 ( )	0 ( )	0 (1)
SILVER	29 (7)	17 (6)	14 (7)	86 (7)	0 ( )	0 ( )	0 (1)
1,2-DICHLOROPROPANE	14 (7)	0 (7)	0 (7)	0 (7)	0 (1)	0 (1)	0 (1)
PENTACHLOROPHENOL	14 (7)	43 (7)	14 (7)	0 (7)	0 ( )	0 ( )	0 (1)
1,3-DICHLOROBENZENE	14 (7)	29 (7)	57 (7)	0 (7)	0 ( )	0 ( )	0 (1)
1,4-DICHLOROBENZENE	14 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
2,6-DINITROTOLUENE	14 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
ISOPHORONE	14 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
BENZO (A)PYRENE	14 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
3,4-BENZOFLUORANTHENE	14 (7)	0 (7)	0 (7)	71 (7)	0 ( )	0 ( )	0 (1)
11,12-BENZOFLUORANTHENE	14 (7)	0 (7)	0 (7)	0 (7)	0 ( )	0 ( )	0 (1)
ACRYLONITRILE	0 (7)	0 (7)	0 (7)	14 (7)	0 (1)	0 (1)	0 (1)
1,3-DICHLOROPROPYLENE	0 (7)	0 (7)	0 (7)	0 (7)	0 (1)	100 (1)	0 (1)
BROMOFORM	0 (7)	0 (7)	0 (7)	0 (7)	0 (1)	100 (1)	100 (1)
TRICHLOROFLUOROMETHANE	0 (7)	14 (7)	0 (7)	0 (7)	0 (1)	0 (1)	0 (1)
DICHLORODIFLUOROMETHANE	0 (7)	0 (7)	0 (7)	0 (7)	0 (1)	100 (1)	0 (1)
2-NITROPHENOL	0 (7)	71 (7)	43 (7)	0 (7)	0 ( )	0 ( )	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 2

PARAMETER	INFL- UENT	PRE CL EFFL.	SEC. EFFL	COMB. SLDG	SEC. SLDG	DAF. SLDG	TAP WATER
4-NITROPHENOL	0 (7)	43 (7)	29 (7)	0 (7)	0 ( )	0 ( )	0 (1)
3,3'-DICHLOROBENZIDINE	0 (7)	0 (7)	14 (7)	0 (7)	0 ( )	0 ( )	0 (1)
1,2-BENZANTHRACENE	0 (7)	14 (7)	14 (7)	29 (7)	0 ( )	0 ( )	0 (1)
CHRYSENE	0 (7)	14 (7)	14 (7)	29 (7)	0 ( )	0 ( )	0 (1)
ACENAPHTHYLENE	0 (7)	14 (7)	29 (7)	0 (7)	0 ( )	0 ( )	0 (1)
ANTIMONY	0 (7)	0 (6)	0 (7)	100 (7)	0 ( )	0 ( )	0 (1)
ARSENIC	0 (7)	0 (6)	0 (7)	100 (7)	0 ( )	0 ( )	0 (1)
BERYLLIUM	0 (7)	0 (6)	0 (7)	86 (7)	0 ( )	0 ( )	0 (1)
SELENIUM	0 (7)	0 (6)	0 (7)	86 (7)	0 ( )	0 ( )	0 (1)
THALLIUM	0 (7)	0 (6)	0 (7)	43 (7)	0 ( )	0 ( )	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 2

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE
CONVENTIONALS	BOD	6373	3156	972	2184
	TOTAL SUSP. SOLIDS	6546	6233	626	5607
	COD	12323	10954	2580	8374
	OIL & GREASE	1637	1446	529	917
NON-CONVENTIONALS	TOTAL PHENOLS	1.3	.3	.2	.1
	TOTAL SOLIDS	41685	44823	38220	6603
	TOTAL VOLATILE SOLIDS	9608	12604	8915	3689
	TOTAL VOL. SUS. SOLIDS	3658	3500	375	3125
	AMMONIA NITROGEN	789	8037	4756	3281
	TOC	4708	4967	1887	3080
VOLATILES	ACRYLONITRILE	N-D	L 0.1	N-D	L 0.1
	BENZENE	.7	.2	.2	L 0.1
	CHLOROBENZENE	L 0.1	N-D	N-D	N-D
	1,2-DICHLOROETHANE	L 0.1	L 0.1	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	L 0.1	L 0.1	L 0.1	N-D
	1,1-DICHLOROETHANE	L 0.1	N-D	N-D	N-D
	CHLOROFORM	.3	.4	.4	N-D
	1,1-DICHLOROETHYLENE	.1	.1	.1	N-D
	1,2-DICHLOROPROPANE	L 0.1	N-D	N-D	N-D
	ETHYLBENZENE	.1	L 0.1	L 0.1	L 0.1
	METHYLENE CHLORIDE	.6	.4	.3	L 0.1
	DICHLOROBROMOMETHANE	L 0.1	.1	.1	L 0.1
	CHLORODIBROMOMETHANE	L 0.1	L 0.1	L 0.1	L 0.1
	TETRACHLOROETHYLENE	.3	.2	.2	L 0.1
	TOLUENE	.3	.3	.2	L 0.1
	TRICHLOROETHYLENE	.1	L 0.1	L 0.1	N-D
ACID EXTRACT	2-NITROPHENOL	N-D	.1	.1	N-D
	4-NITROPHENOL	N-D	1.0	1.0	N-D
	PENTACHLOROPHENOL	L 0.1	L 0.1	L 0.1	N-D
	PHENOL	.2	.3	.3	L 0.1
BASE-NEUTRALS	1,2-DICHLOROBENZENE	.2	L 0.1	L 0.1	N-D
	1,3-DICHLOROBENZENE	L 0.1	.2	.2	N-D
	1,4-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D
	3,3'-DICHLOROBENZIDINE	N-D	L 0.1	L 0.1	N-D
	2,6-DINITROTOLUENE	L 0.1	N-D	N-D	N-D
	FLUORANTHENE	.1	N-D	N-D	N-D
	ISOPHORONE	L 0.1	N-D	N-D	N-D
	NAPHTHALENE	.2	.1	L 0.1	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	.7	.7	.3	.4
	BUTYL BENZYL PHTHALATE	.3	.2	.2	L 0.1
	DI-N-BUTYL PHTHALATE	.3	.2	.2	N-D
	DI-N-OCTYL PHTHALATE	.2	L 0.1	L 0.1	N-D
	DIETHYL PHTHALATE	.3	L 0.1	L 0.1	N-D
	DIMETHYL PHTHALATE	.1	L 0.1	L 0.1	N-D
	1,2-BENZANTHRACENE	N-D	L 0.1	L 0.1	L 0.1
	BENZO (A)PYRENE	L 0.1	N-D	N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 2

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE
BASE-NEUTRALS	3,4-BENZOFLUORANTHENE	L 0.1	L 0.1	N-D	L 0.1
	11,12-BENZOFLUORANTHENE	L 0.1	N-D	N-D	N-D
	CHRYSENE	N-D	L 0.1	L 0.1	L 0.1
	ACENAPHTHYLENE	N-D	L 0.1	L 0.1	N-D
	ANTHRACENE	L 0.1	L 0.1	N-D	L 0.1
	PHENANTHRENE	L 0.1	L 0.1	N-D	L 0.1
	PYRENE	.1	L 0.1	N-D	L 0.1
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1
	ARSENIC	N-D	L 0.1	N-D	L 0.1
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1
	CADMIUM	.3	L 0.1	N-D	L 0.1
	CHROMIUM	4.8	3.6	1.5	2.1
	COPPER	3.6	3.5	.7	2.8
	CYANIDE	5.2	10.1	9.6	.5
	LEAD	1.1	2.1	.2	1.9
	MERCURY	L 0.1	L 0.1	L 0.1	L 0.1
	NICKEL	2.0	2.1	1.3	.8
	SELENIUM	N-D	L 0.1	N-D	L 0.1
	SILVER	L 0.1	L 0.1	L 0.1	L 0.1
	THALLIUM	N-D	L 0.1	N-D	L 0.1
	ZINC	18.7	10.4	3.5	6.9
NON-CONV. METALS	ALUMINUM	36.2	-	3.4	NOT RUN
	BARIUM	5.0	-	1.7	NOT RUN
	CALCIUM	3928	-	4400	NOT RUN
	IRON	111	-	12.7	NOT RUN
	MAGNESIUM	828	-	818	NOT RUN
	MANGANESE	18.9	-	11.8	NOT RUN
	MOLYBDENUM	NOT RUN	-	.4	NOT RUN
	SODIUM	NOT RUN	-	404	NOT RUN
	TIN	NOT RUN	-	.4	NOT RUN
	TITANIUM	NOT RUN	-	.4	NOT RUN
	VANADIUM	NOT RUN	-	.4	NOT RUN
	YTTRIUM	NOT RUN	-	.4	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 3

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	PRIMARY SLUDGE	COMBINED SLUDGE
CONVENTIONALS	BOD	MG/L	134	14	90	12	5538	4426
	TOTAL SUSP. SOLIDS	MG/L	265	44	83	12	40039	31859
	COD	MG/L	417	45	89	49	44850	22577
	OIL & GREASE	MG/L	44	4	91	6	8604	1799
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	116	15	87	11	3377	1615
	TOTAL SOLIDS	MG/L	555	351	37	322	41947	38026
	TOTAL DISS. SOLIDS	MG/L	279	299		293	1821	6076
	SETTLEABLE SOLIDS	ML/L	6	L 1	88	L 1	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	MG/L	235	77	67	76	29725	20567
	VOLATILE DISS. SOLIDS	MG/L	67	58	13	69	573	2619
	TOTAL VOL. SUS. SOLIDS	MG/L	151	15	90	4	29065	17682
	AMMONIA NITROGEN	MG/L	14	1	93	1	120	31
	TOC	MG/L	216	34	84	24	21771	15194
VOLATILES	BENZENE	UG/L	5	L 5		L 5	34	2
	1,1,1-TRICHLOROETHANE	UG/L	64	5	92	5	17	N-D
	1,1-DICHLOROETHANE	UG/L	0	L 5		L 5	N-D	N-D
	CHLOROFORM	UG/L	40	23	42	6	N-D	N-D
	1,1-DICHLOROETHYLENE	UG/L	4	L 5		L 5	2373	N-D
	1,2-DICHLOROPROPANE	UG/L	0	L 5		L 5	10	N-D
	ETHYLBENZENE	UG/L	42	L 5	88	L 5	203	96
	METHYLENE CHLORIDE	UG/L	12	5	58	5	8	1
	METHYL CHLORIDE	UG/L	L 5	L 5		L 5	33	N-D
	DICHLOROBROMOMETHANE	UG/L	L 5	1		L 5	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	0	L 5		L 5	N-D	N-D
	CHLORODIBROMOMETHANE	UG/L	L 5	1		L 5	N-D	N-D
	TETRACHLOROETHYLENE	UG/L	51	3	94	9	N-D	1601
	TOLUENE	UG/L	15	1	93	1	260	54
	TRICHLOROETHYLENE	UG/L	4	1	75	4	38	N-D
	VINYL CHLORIDE	UG/L	L 5	L 5		L 5	301	N-D
ACID EXTRACT	PENTACHLOROPHENOL	UG/L	L 50	L 50		L 50	N-D	30
	PHENOL	UG/L	16	L 50		L 50	277	4310
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	UG/L	L 10	L 10		L 10	41	N-D
	1,2-DICHLOROBENZENE	UG/L	0	L 10		L 10	N-D	N-D
	1,3-DICHLOROBENZENE	UG/L	0	L 10		L 10	N-D	N-D
	1,4-DICHLOROBENZENE	UG/L	0	L 10		L 10	25	N-D
	FLUORANTHENE	UG/L	0	L 10		L 10	67	23

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 3

FRACTION	PARAMETER	UNITS	INFLUENT	SECUNDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	PRIMARY SLUDGE	COMBINED SLUDGE
BASE-NEUTRALS	NAPHTHALENE	UG/L	3	L 10		L 10	78	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	29	5	83	9	300	157
	BUTYL BENZYL PHTHALATE	UG/L	6	L 10		L 10	57	N-D
	DI-N-BUTYL PHTHALATE	UG/L	7	5	29	3	263	37
	DI-N-OCTYL PHTHALATE	UG/L	4	L 10		L 10	N-D	N-D
	DIETHYL PHTHALATE	UG/L	5	1	80	1	N-D	N-D
	DIMETHYL PHTHALATE	UG/L	2	L 10		L 10	N-D	N-D
	1,2-BENZANTHRACENE	UG/L	0	L 10		L 10	15	N-D
	BENZO (A)PYRENE	UG/L	0	L 10		L 10	N-D	N-D
	3,4-BENZOFLUORANTHENE	UG/L	0	L 5		L 5	N-D	N-D
	11,12-BENZOFLUORANTHENE	UG/L	0	L 5		L 5	N-D	N-D
	CHRYSENE	UG/L	0	L 10		L 10	15	N-D
	ANTHRACENE	UG/L	2	L 10		L 10	260	104
	FLUORENE	UG/L	L 10	L 10		L 10	10	N-D
	PHENANTHRENE	UG/L	2	L 10		L 10	260	104
	PYRENE	UG/L	0	L 10		L 10	66	32
METALS	ANTIMONY	UG/L	L 4	L 4		L 4	130	52
	ARSENIC	UG/L	3	L 5		2	403	138
	BERYLLIUM	UG/L	L 1	0		L 5	13	10
	CADMIUM	UG/L	4	6		1	232	42
	CHROMIUM	UG/L	29	10	66	7	5000	4750
	COPPER	UG/L	295	43	85	39	25667	20500
	CYANIDE	UG/L	96	138		53	20530	7223
	LEAD	UG/L	97	44	55	30	6833	1475
	MERCURY	NG/L	L 1000	L 1000		L 1000	47333	29250
	NICKEL	UG/L	59	89		42	647	478
	SELENIUM	UG/L	L 4	L 4		L 4	28	12
	SILVER	UG/L	2	L 4		L 4	417	368
	ZINC	UG/L	317	61	81	70	27667	16000
NON-CONV. METALS	ALUMINUM	UG/L	2384	251	89	79	NOT RUN	NOT RUN
	BARIUM	UG/L	116	1	99	L 1	NOT RUN	NOT RUN
	BORON	UG/L	289	256	11	252	NOT RUN	NOT RUN
	CALCIUM	MG/L	24	19	21	27	NOT RUN	NOT RUN
	COBALT	UG/L	26	11	58	6	NOT RUN	NOT RUN
	IRON	UG/L	12028	233	98	116	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	4	3	25	3	NOT RUN	NOT RUN
	MANGANESE	UG/L	303	23	92	17	NOT RUN	NOT RUN
	MOLYBDENUM	UG/L	147	151		152	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 3

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	PRIMARY SLUDGE	COMBINED SLUDGE
NON-CONV. METALS	SODIUM	MG/L	58	66		66	NOT RUN	NOT RUN
	TIN	UG/L	40	4	90	3	NOT RUN	NOT RUN
	TITANIUM	UG/L	159	6	96	3	NOT RUN	NOT RUN
	VANADIUM	UG/L	71	29	59	28	NOT RUN	NOT RUN
	YTTRIUM	UG/L	4	6		4	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 3

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	PRIMARY SLUDGE
CONVENTIONALS	BOD	11864	3286	1258	2028	923
	TOTAL SUSP. SOLIDS	23439	18437	3841	14596	6671
	COD	36836	14272	3929	10343	7472
	OIL & GREASE	3893	1177	353	824	1433
NON-CONVENTIONALS	TOTAL PHENOLS	10267	2042	1302	740	563
	TOTAL SOLIDS	48989	48434	31015	17419	6988
	TOTAL DISS. SOLIDS	24627	29141	26357	2784	303
	TOTAL VOLATILE SOLIDS	20718	16209	6777	9432	4952
	VOLATILE DISS. SOLIDS	5876	6321	5121	1200	95.5
	TOTAL VOL. SUS. SOLIDS	13301	9473	1280	8193	4842
	AMMONIA NITROGEN	1.4	.1	.1	L 0.1	L 0.1
	TOC	19088	9941	2980	6961	3627
VOLATILES	BENZENE	.2	L 0.1	N-D	L 0.1	L 0.1
	1,1,1-TRICHLOROETHANE	5.2	.2	.2	N-D	L 0.1
	1,1-DICHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	2-CHLOROETHYL VINYL ETHER	L 0.1	N-D	N-D	N-D	N-D
	CHLOROFORM	3.5	2.4	2.4	N-D	N-D
	1,1-DICHLOROETHYLENE	.1	N-D	N-D	N-D	.4
	1,2-DICHLOROPROPANE	L 0.1	N-D	N-D	N-D	L 0.1
	ETHYLBENZENE	3.2	L 0.1	N-D	L 0.1	L 0.1
	METHYLENE CHLORIDE	.9	.2	.2	L 0.1	L 0.1
	METHYL CHLORIDE	N-D	N-D	N-D	N-D	L 0.1
	DICHLOROBROMOMETHANE	L 0.1	.4	L 0.1	N-D	N-D
	TRICHLOROFLUOROMETHANE	L 0.1	N-D	N-D	N-D	N-D
	CHLORODIBROMOMETHANE	N-D	L 0.1	L 0.1	N-D	N-D
	TETRACHLOROETHYLENE	4.0	1.0	.3	.7	N-D
	TOLUENE	1.2	.1	.1	L 0.1	L 0.1
	TRICHLOROETHYLENE	.2	N-D	N-D	N-D	L 0.1
	VINYL CHLORIDE	N-D	N-D	N-D	N-D	L 0.1
ACID EXTRACT	PENTACHLOROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	PHENOL	2.2	2.0	N-D	2.0	L 0.1
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	N-D	N-D	N-D	N-D	L 0.1
	1,2-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D	N-D
	1,3-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D	N-D
	1,4-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D	L 0.1
	FLUORANTHENE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	NAPHTHALENE	.2	N-D	N-D	N-D	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	2.5	.5	.4	L 0.1	L 0.1
	BUTYL BENZYL PHTHALATE	.5	N-D	N-D	N-D	L 0.1
	DI-N-BUTYL PHTHALATE	.6	.4	.4	L 0.1	L 0.1
	DI-N-OCTYL PHTHALATE	.4	N-D	N-D	N-D	N-D
	DIETHYL PHTHALATE	.4	.1	.1	N-D	N-D
	DIMETHYL PHTHALATE	.2	N-D	N-D	N-D	N-D
	1,2-BENZANTHRACENE	L 0.1	N-D	N-D	N-D	L 0.1
	BENZO (A)PYRENE	L 0.1	N-D	N-D	N-D	N-D

PRIMARY SLUDGE QUANTITY IS NOT INCLUDED IN TOTAL OUT COLUMN (INCLUDED IN COMBINED SLUDGE)
POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 3

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	PRIMARY SLUDGE
BASE-NEUTRALS	3,4-BENZOFLUORANTHENE	L 0.1	N-D	N-D	N-D	N-D
	11,12-BENZOFLUORANTHENE	L 0.1	N-D	N-D	N-D	N-D
	CHRYSENE	L 0.1	N-D	N-D	N-D	L 0.1
	ANTHRACENE	.2	L 0.1	N-D	L 0.1	L 0.1
	FLUORENE	N-D	N-D	N-D	N-D	L 0.1
	PHENANTHRENE	.2	L 0.1	N-D	L 0.1	L 0.1
	PYRENE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1	L 0.1
	ARSENIC	.2	L 0.1	N-D	L 0.1	L 0.1
	BERYLLIUM	N-D	L 0.1	L 0.1	L 0.1	L 0.1
	CADMIUM	.4	.5	.5	L 0.1	L 0.1
	CHROMIUM	2.5	3.0	.8	2.2	.7
	COPPER	25.1	13.2	3.8	9.4	4.3
	CYANIDE	8.5	6.5	3.2	3.3	3.4
	LEAD	8.5	4.6	3.9	.7	1.1
	NICKEL	5.5	8.0	7.8	.2	.1
	SELENIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	SILVER	L 0.1	.2	N-D	.2	L 0.1
	ZINC	28.0	12.7	5.4	7.3	4.6
NON-CONV. METALS	ALUMINUM	210	-	22.1	NOT RUN	NOT RUN
	BARIUM	10.2	-	.1	NOT RUN	NOT RUN
	BORON	25.5	-	22.7	NOT RUN	NOT RUN
	CALCIUM	2154	-	1656	NOT RUN	NOT RUN
	COBALT	2.3	-	.9	NOT RUN	NOT RUN
	IRON	1062	-	18.5	NOT RUN	NOT RUN
	MAGNESIUM	371	-	243	NOT RUN	NOT RUN
	MANGANESE	30.2	-	2.0	NOT RUN	NOT RUN
	MOLYBDENUM	13.0	-	13.3	NOT RUN	NOT RUN
	SODIUM	5077	-	5850	NOT RUN	NOT RUN
	TIN	3.6	-	.4	NOT RUN	NOT RUN
	TITANIUM	14.1	-	.5	NOT RUN	NOT RUN
	VANADIUM	6.3	-	2.5	NOT RUN	NOT RUN
	YTTRIUM	.3	-	.5	NOT RUN	NOT RUN

PRIMARY SLUDGE QUANTITY IS NOT INCLUDED IN TOTAL OUT COLUMN (INCLUDED IN COMBINED SLUDGE)
POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 3

PARAMETER	INFL-UENT	PRE CL EFFL.	SEC. EFFL	PRIM. SLDG	COMB. SLDG	TAP WATER	THICKENER OVERFLOW
1,1,1-TRICHLOROETHANE	100 (11)	100 (4)	100 (4)	33 (3)	0 (4)	0 (1)	100 (1)
CHLOROFORM	100 (11)	100 (4)	100 (4)	0 (3)	0 (4)	100 (1)	100 (1)
METHYLENE CHLORIDE	100 (11)	100 (4)	100 (4)	33 (3)	25 (4)	100 (1)	100 (1)
TETRACHLOROETHYLENE	100 (11)	75 (4)	50 (4)	0 (3)	100 (4)	0 (1)	100 (1)
TOLUENE	100 (11)	25 (4)	25 (4)	33 (3)	75 (4)	0 (1)	100 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (11)	100 (4)	100 (4)	100 (3)	75 (4)	100 (1)	100 (1)
BUTYL BENZYL PHTHALATE	100 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
DI-N-BUTYL PHTHALATE	100 (11)	50 (4)	100 (4)	33 (3)	50 (4)	100 (1)	100 (1)
CHROMIUM	100 (10)	67 (3)	100 (4)	100 (3)	100 (4)	100 (1)	100 (1)
COPPER	100 (10)	100 (3)	100 (4)	100 (3)	100 (4)	100 (1)	100 (1)
CYANIDE	100 (11)	100 (4)	100 (4)	100 (3)	100 (4)	0 (1)	100 (1)
LEAD	100 (10)	67 (3)	100 (4)	100 (3)	100 (4)	100 (1)	100 (1)
ZINC	100 (10)	100 (3)	100 (4)	100 (3)	100 (4)	0 (1)	100 (1)
BENZENE	91 (11)	0 (4)	0 (4)	67 (3)	25 (4)	0 (1)	0 (1)
ETHYLBENZENE	91 (11)	0 (4)	0 (4)	33 (3)	75 (4)	0 (1)	100 (1)
PHENOL	91 (11)	0 (4)	0 (4)	67 (3)	100 (4)	0 (1)	100 (1)
CADMIUM	90 (10)	67 (3)	75 (4)	100 (3)	100 (4)	100 (1)	0 (1)
NICKEL	90 (10)	67 (3)	100 (4)	100 (3)	100 (4)	100 (1)	100 (1)
TRICHLOROETHYLENE	82 (11)	75 (4)	25 (4)	67 (3)	0 (4)	100 (1)	100 (1)
DIETHYL PHTHALATE	82 (11)	25 (4)	25 (4)	0 (3)	0 (4)	0 (1)	0 (1)
1,1-DICHLOROETHYLENE	73 (11)	0 (4)	0 (4)	67 (3)	0 (4)	0 (1)	100 (1)
NAPHTHALENE	55 (11)	0 (4)	0 (4)	67 (3)	0 (4)	0 (1)	100 (1)
DI-N-OCTYL PHTHALATE	45 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
DIMETHYL PHTHALATE	45 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
ARSENIC	40 (10)	33 (3)	0 (4)	100 (3)	100 (4)	0 (1)	100 (1)
ANTHRACENE	36 (11)	0 (4)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
PHENANTHRENE	36 (11)	0 (4)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
SILVER	30 (10)	0 (3)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
1,1-DICHLOROETHANE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
1,2-DICHLOROPROPANE	9 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
TRICHLOROFLUOROMETHANE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
1,2-DICHLOROBENZENE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
1,3-DICHLOROBENZENE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
1,4-DICHLOROBENZENE	9 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
FLUORANTHENE	9 (11)	0 (4)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
1,2-BENZANTHRACENE	9 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
BENZO (A)PYRENE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
3,4-BENZOFLUORANTHENE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
11,12-BENZOFLUORANTHENE	9 (11)	0 (4)	0 (4)	0 (3)	0 (4)	0 (1)	0 (1)
CHRYSENE	9 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
PYRENE	9 (11)	0 (4)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
METHYL CHLORIDE	0 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
DICHLOROBROMOMETHANE	0 (11)	0 (4)	25 (4)	0 (3)	0 (4)	100 (1)	0 (1)
CHLORODIBROMOMETHANE	0 (11)	0 (4)	25 (4)	0 (3)	0 (4)	0 (1)	0 (1)
VINYL CHLORIDE	0 (11)	0 (4)	0 (4)	67 (3)	0 (4)	0 (1)	0 (1)
PENTACHLOROPHENOL	0 (11)	0 (4)	0 (4)	0 (3)	25 (4)	0 (1)	0 (1)
1,2,4-TRICHLOROBENZENE	0 (11)	0 (4)	0 (4)	67 (3)	0 (4)	0 (1)	0 (1)
FLUORENE	0 (11)	0 (4)	0 (4)	33 (3)	0 (4)	0 (1)	0 (1)
ANTIMONY	0 (10)	0 (3)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)
BERYLLIUM	0 (10)	0 (3)	25 (4)	100 (3)	100 (4)	0 (1)	0 (1)
MERCURY	0 (10)	0 (3)	0 (4)	100 (3)	75 (4)	0 (1)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 3

PARAMETER	INFL-UENT	PRE CL EFFL.	SEC. EFFL	PRIM. SLDG	COMB. SLDG	TAP WATER	THICKENER OVERFLOW
SELENIUM	0 (10)	0 (3)	0 (4)	100 (3)	100 (4)	0 (1)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETFCTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 4

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	DIGESTED SLUDGE
CONVENTIONALS	BOD	MG/L	152	22	86	18300	5500
	TOTAL SUSP. SOLIDS	MG/L	164	43	74	59667	41917
	COD	MG/L	343	81	76	59763	34083
	OIL & GREASE	MG/L	117	16	86	10126	9048
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	123	28	77	677	1158
	TOTAL SOLIDS	MG/L	402	276	31	63583	45917
	TOTAL DISS. SOLIDS	MG/L	252	207	18	1790	659
	SETTLEABLE SOLIDS	ML/L	5	0	100	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	MG/L	178	112	37	34683	21533
	VOLATILE DISS. SOLIDS	MG/L	60	59	27	1058	405
	TOTAL VOL. SUS. SOLIDS	MG/L	116	29	75	29933	15067
	AMMONIA NITROGEN	MG/L	9	8	11	207	523
	TOC	MG/L	99	38	62	14538	11602
VOLATILES	BENZENE	UG/L	L 1	L 1		43	20
	CARBON TETRACHLORIDE	UG/L	L 2	L 2		270	N-D
	CHLOROBENZENE	UG/L	L 1	L 1		N-D	252
	1,2-DICHLOROETHANE	UG/L	L 2	L 2		N-D	65
	1,1,1-TRICHLOROETHANE	UG/L	284	89	69	507	37
	1,1,2-TRICHLOROETHANE	UG/L	L 2	L 2		441	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	18	2	89	43	194
	CHLOROFORM	UG/L	8	3	63	1	N-D
	1,1-DICHLOROETHYLENE	UG/L	13	3	77	2347	3
	1,2-TRANS-DICHLOROETHYLENE	UG/L	25	7	72	54993	9000
	1,2-DICHLOROPROPANE	UG/L	L 1	L 1		4	7
	ETHYLBENZENE	UG/L	44	L 1	98	1467	910
	METHYLENE CHLORIDE	UG/L	282	128	55	142	16
	DICHLOROBROMOMETHANE	UG/L	L 1	L 1		64	N-D
	TETRACHLOROETHYLENE	UG/L	385	134	65	958	10
	TOLUENE	UG/L	36	0	100	984	1647
	TRICHLOROETHYLENE	UG/L	497	37	93	467	120
	VINYL CHLORIDE	UG/L	L 33	L 33		N-D	27
ACID EXTRACT	2,4-DIMETHYLPHENOL	UG/L	3	L 1	67	N-D	N-D
	2-NITROPHENOL	UG/L	L 2	L 2		N-D	37
	2,4-DINITROPHENOL	UG/L	L 50	L 50		N-D	200
	PENTACHLOROPHENOL	UG/L	9	L 5	44	25	N-D
	PHENOL	UG/L	16	1	94	103	70
BASE-NEUTRALS	ACENAPHTHENE	UG/L	L 4	L 4		N-D	65

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 4

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	DIGESTED SLUDGE
BASE-NEUTRALS	1,2-DICHLOROBENZENE	UG/L	105	6	94	262	116
	1,3-DICHLOROBENZENE	UG/L	L 5	L 5		252	10
	1,4-DICHLOROBENZENE	UG/L	13	2	85	1128	435
	FLUORANTHENE	UG/L	L 3	L 3		114	51
	ISOPHORONE	UG/L	L 10	3		N-D	N-D
	NAPHTHALENE	UG/L	51	L 3	74	640	445
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	31	11	65	8166	8437
	BUTYL BENZYL PHTHALATE	UG/L	60	2	97	2650	4406
	DI-N-BUTYL PHTHALATE	UG/L	18	6	67	427	33
	DIETHYL PHTHALATE	UG/L	7	1	86	N-D	N-D
	DIMETHYL PHTHALATE	UG/L	3	L 3		N-D	N-D
	1,2-BENZANTHRACENE	UG/L	L 3	L 3		16	59
	3,4-BENZOFLUORANTHENE	UG/L	L 9	L 8		23	25
	11,12-BENZOFLUORANTHENE	UG/L	L 8	L 8		23	25
	CHRYSENE	UG/L	L 3	L 3		15	59
	ACENAPHTHYLENE	UG/L	L 2	L 2		N-D	20
	ANTHRACENE	UG/L	3	L 3		602	375
	FLUORENE	UG/L	L 3	L 3		19	36
	PHENANTHRENE	UG/L	0	L 3		602	375
	INDENO(1,2,3-C,D) PYRENE	UG/L	1	L 15		N-D	N-D
	PYRENE	UG/L	L [illegible]	L 2		121	93
PESTICIDES	DIELDRIN	NG/L	5	L 30		L 1000	L 1000
	HEPTACHLOR	NG/L	13	L 20		L 1000	L 1000
	ALPHA-BHC	NG/L	L 30	5		L 1000	L 1000
	GAMMA-BHC	NG/L	55	163		L 1000	L 1000
METALS	ANTIMONY	UG/L	L 50	L 50		116	116
	ARSENIC	UG/L	L 50	L 50		403	333
	BERYLLIUM	UG/L	L 2	L 2		25	30
	CADMIUM	UG/L	2	1	50	518	660
	CHROMIUM	UG/L	60	29	54	17500	25833
	COPPER	UG/L	47	17	64	10000	15333
	CYANIDE	UG/L	37	12	68	193	407
	LEAD	UG/L	127	53	58	41000	49333
	MERCURY	NG/L	1250	450	64	360000	463333
	NICKEL	UG/L	20	7	55	2567	3083
	SELENIUM	UG/L	L 50	L 50		20	23
	SILVER	UG/L	18	3	83	1967	2378
	ZINC	UG/L	494	223	55	143333	171667

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 4

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	DIGESTED SLUDGE
NON-CONV. METALS	ALUMINUM	UG/L	2460	584	76	NOT RUN	NOT RUN
	BARIUM	UG/L	133	33	75	NOT RUN	NOT RUN
	CALCIUM	MG/L	16	35		NOT RUN	NOT RUN
	IRON	UG/L	7350	2355	68	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	3	2	33	NOT RUN	NOT RUN
	MANGANESE	UG/L	633	179	72	NOT RUN	NOT RUN
	SODIUM	MG/L	32	29	9	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 4

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	COMBINED SLUDGE
CONVENTIONALS	BOD	105745	28734	14990	13744	30488
	TOTAL SUSP. SOLIDS	113996	134382	29632	104750	99405
	COD	239031	141765	57591	85174	99599
	OIL & GREASE	81691	33651	11039	22612	16874
NON-CONVENTIONALS	TOTAL PHENOLS	85642	22533	19638	2895	1127
	TOTAL SOLIDS	280283	307411	192665	114746	105930
	TOTAL DISS. SOLIDS	175351	145738	144092	1646	2982
	TOTAL VOLATILE SOLIDS	123757	131552	77740	53812	57782
	VOLATILE DISS. SOLIDS	55778	41103	40090	1013	1762
	TOTAL VOL. SUS. SOLIDS	81342	57871	20219	37652	49869
	AMMONIA NITROGEN	6.4	7.1	5.8	1.3	.3
	TOC	69257	55604	26611	28993	59707
VOLATILES	BENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	CARBON TETRACHLORIDE	N-D	N-D	N-D	N-D	.4
	CHLOROBENZENE	N-D	.6	N-D	.6	N-D
	1,2-DICHLOROETHANE	N-D	.2	N-D	.2	N-D
	1,1,1-TRICHLOROETHANE	198	61.9	61.8	L 0.1	.8
	1,1,2-TRICHLOROETHANE	N-D	N-D	N-D	N-D	.7
	1,1,2,2-TETRACHLOROETHANE	12.8	1.5	1.0	.5	L 0.1
	CHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	BIS(CHLOROMETHYL) ETHER	NOT RUN	-	NOT-RUN	L 0.1	N-D
	2-CHLOROETHYL VINYL ETHER	N-D	L 0.1	N-D	L 0.1	N-D
	CHLOROFORM	5.5	2.1	2.1	L 0.1	L 0.1
	1,1-DICHLOROETHYLENE	8.7	2.2	2.2	L 0.1	3.9
	1,2-TRANS-DICHLOROETHYLENE	17.4	29.6	5.1	24.5	91.6
	1,2-DICHLOROPROPANE	N-D	L 0.1	N-D	L 0.1	L 0.1
	ETHYLBENZENE	30.9	2.3	N-D	2.3	2.4
	METHYLENE CHLORIDE	197	89.0	89.0	L 0.1	.2
	DICHLOROBROMOMETHANE	N-D	N-D	N-D	N-D	.1
	TETRACHLOROETHYLENE	268	93.2	93.2	L 0.1	1.6
	TOLUENE	25.0	6.1	1.5	4.6	1.6
	TRICHLOROETHYLENE	346	26.2	25.9	.3	.8
	VINYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	N-D
ACID EXTRACT	2,4-DIMETHYLPHENOL	1.4	N-D	N-D	N-D	N-D
	2-NITROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	2,4-DINITROPHENOL	N-D	.5	N-D	.5	N-D
	PENTACHLOROPHENOL	3.8	N-D	N-D	N-D	L 0.1
	PHENOL	9.8	.5	.3	.2	.2
BASE-NEUTRALS	ACENAPHTHENE	N-D	.2	N-D	.2	N-D
	1,2-DICHLOROBENZENE	73.4	4.4	4.1	.3	.5
	1,3-DICHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	.4
	1,4-DICHLOROBENZENE	9.4	2.9	1.8	1.1	1.9
	FLUORANTHENE	N-D	.1	N-D	.1	.2
	ISOPHORONE	N-D	1.4	L 0.1	N-D	N-D
	NAPHTHALENE	35.3	1.1	N-D	1.1	1.1

COMBINED SLUDGE QUANTITY IS NOT INCLUDED IN TOTAL OUT COLUMN (INCLUDED IN DIGESTED SLUDGE)
POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 4

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	COMBINED SLUDGE
BASE-NEUTRALS	N-NITROSODIMETHYLAMINE	N-D	2.1	L 0.1	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	21.5	29.0	7.9	21.1	13.6
	BUTYL BENZYL PHTHALATE	41.5	12.2	1.2	11.0	4.4
	DI-N-BUTYL PHTHALATE	12.3	4.4	4.3	L 0.1	.7
	DIETHYL PHTHALATE	5.1	.2	.2	N-D	N-D
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	3,4-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	11,12-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	CHRYSENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	ACENAPHTHYLENE	N-D	L 0.1	N-D	L 0.1	N-D
	ANTHRACENE	.2	.9	N-D	.9	1.0
	FLUORENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	PHENANTHRENE	.2	.9	N-D	.9	1.0
	INDENO(1,2,3-C,D) PYRENE	.6	N-D	N-D	N-D	N-D
	PYRENE	N-D	.2	N-D	.2	.2
PESTICIDES	DIELDRIN	L 0.1	N-D	N-D	N-D	N-D
	HEPTACHLOR	L 0.1	N-D	N-D	N-D	N-D
	ALPHA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	L 0.1	.1	L 0.1	N-D	N-D
METALS	ANTIMONY	N-D	.3	N-D	.3	.2
	ARSENIC	N-D	.8	N-D	.8	.7
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	1.6	1.9	.3	1.6	.9
	CHROMIUM	56.0	85.7	20.3	65.4	29.4
	COPPER	32.4	50.2	11.9	38.3	18.0
	CYANIDE	25.6	9.1	8.1	1.0	.3
	LEAD	88.3	160	36.7	123	68.3
	MERCURY	.9	-	.3	NOT RUN	NOT RUN
	NICKEL	14.2	12.7	5.0	7.7	4.3
	SELENIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	SILVER	12.2	8.2	2.3	5.9	3.3
	ZINC	344	585	156	429	239
NON-CONV. METALS	ALUMINUM	1715	-	407	NOT RUN	NOT RUN
	BARIUM	105	-	26.3	NOT RUN	NOT RUN
	CALCIUM	11272	-	25216	NOT RUN	NOT RUN
	IRON	5130	-	1649	NOT RUN	NOT RUN
	MAGNESIUM	1975	-	1394	NOT RUN	NOT RUN
	MANGANESE	163	-	125	NOT RUN	NOT RUN
	SODIUM	22079	-	20452	NOT RUN	NOT RUN

COMBINED SLUDGE QUANTITY IS NOT INCLUDED IN TOTAL OUT COLUMN (INCLUDED IN DIGESTED SLUDGE)
POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 4

PARAMETER	INFLUENT		SECONDARY EFFLUENT		COMBINED SLUDGE		DIGESTED SLUDGE	
1,1,1-TRICHLOROETHANE	100	(6)	100	(6)	50	(6)	17	(6)
CHLOROFORM	100	(6)	100	(6)	17	(6)	0	(6)
1,2-TRANS-DICHLOROETHYLENE	100	(6)	100	(6)	100	(6)	83	(6)
METHYLENE CHLORIDE	100	(6)	100	(6)	100	(6)	50	(6)
TRICHLOROETHYLENE	100	(6)	100	(6)	100	(3)	33	(6)
PENTACHLOROPHENOL	100	(6)	0	(6)	50	(6)	0	(6)
PHENOL	100	(6)	50	(6)	67	(6)	50	(6)
1,2-DICHLOROBENZENE	100	(6)	50	(6)	50	(6)	50	(6)
NAPHTHALENE	100	(6)	0	(6)	100	(6)	100	(6)
BIS(2-ETHYLHEXYL) PHTHALATE	100	(6)	100	(6)	100	(6)	100	(6)
BUTYL BENZYL PHTHALATE	100	(6)	83	(6)	67	(6)	100	(6)
DI-N-BUTYL PHTHALATE	100	(6)	100	(6)	83	(6)	33	(6)
DIETHYL PHTHALATE	100	(6)	33	(6)	0	(6)	0	(6)
CHROMIUM	100	(6)	100	(6)	100	(6)	100	(6)
COPPER	100	(6)	100	(6)	100	(6)	100	(6)
LEAD	100	(6)	83	(6)	100	(6)	100	(6)
MERCURY	100	(6)	100	(6)	100	(5)	100	(6)
SILVER	100	(6)	33	(6)	100	(6)	100	(6)
ZINC	100	(6)	100	(6)	100	(6)	100	(6)
1,1,2,2-TETRACHLOROETHANE	83	(6)	50	(6)	60	(5)	33	(6)
1,1-DICHLOROETHYLENE	83	(6)	83	(6)	33	(6)	17	(6)
ETHYLBENZENE	83	(6)	0	(6)	83	(6)	100	(6)
TOLUENE	83	(6)	17	(6)	100	(6)	100	(6)
1,4-DICHLOROBENZENE	83	(6)	50	(6)	67	(6)	67	(6)
CYANIDE	83	(6)	67	(6)	100	(6)	100	(6)
NICKEL	83	(6)	33	(6)	100	(6)	100	(6)
TETRACHLOROETHYLENE	67	(6)	100	(6)	83	(6)	33	(6)
CADMIUM	67	(6)	17	(6)	100	(6)	100	(6)
2,4-DIMETHYLPHENOL	50	(6)	0	(6)	0	(6)	0	(6)
GAMMA-BHC	50	(6)	67	(6)	0	(6)	0	(6)
DIMETHYL PHTHALATE	17	(6)	0	(6)	0	(6)	0	(6)
ANTHRACENE	17	(6)	0	(6)	100	(6)	100	(6)
PHENANTHRENE	17	(6)	0	(6)	100	(6)	100	(6)
INDENO(1,2,3-C,D) PYRENE	17	(6)	0	(6)	0	(6)	0	(6)
DIELDRIN	17	(6)	0	(6)	0	(6)	0	(6)
HEPTACHLOR	17	(6)	0	(6)	0	(6)	0	(6)
BENZENE	0	(6)	0	(6)	100	(6)	83	(6)
CARBON TETRACHLORIDE	0	(6)	0	(6)	33	(6)	0	(6)
CHLOROBENZENE	0	(6)	0	(6)	0	(6)	67	(6)
1,2-DICHLOROETHANE	0	(6)	0	(6)	0	(6)	17	(6)
1,1,2-TRICHLOROETHANE	0	(6)	0	(6)	60	(5)	0	(6)
1,2-DICHLOROPROPANE	0	(6)	0	(6)	17	(6)	33	(6)
DICHLOROBROMOMETHANE	0	(6)	0	(6)	50	(6)	0	(6)
VINYL CHLORIDE	0	(6)	0	(6)	0	(6)	17	(6)
2-NITROPHENOL	0	(6)	0	(6)	0	(6)	33	(6)
2,4-DINITROPHENOL	0	(6)	0	(6)	0	(6)	17	(6)
ACENAPHTHENE	0	(6)	0	(6)	0	(6)	17	(6)
1,3-DICHLOROBENZENE	0	(6)	0	(6)	33	(6)	17	(6)
FLUORANTHENE	0	(6)	0	(6)	83	(6)	67	(6)
ISOPHORONE	0	(6)	33	(6)	0	(6)	0	(6)
1,2-BENZANTHRACENE	0	(6)	0	(6)	33	(6)	33	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 4

PARAMETER	INFLUENT		SECONDARY EFFLUENT		COMBINED SLUDGE		DIGESTED SLUDGE	
3,4-BENZOFLUORANTHENE	0	(6)	0	(6)	17	(6)	17	(6)
11,12-BENZOFLUORANTHENE	0	(6)	0	(6)	17	(6)	17	(6)
CHRYSENE	0	(6)	0	(6)	33	(6)	33	(6)
ACENAPHTHYLENE	0	(6)	0	(6)	0	(6)	17	(6)
FLUORENE	0	(6)	0	(6)	33	(6)	17	(6)
PYRENE	0	(6)	0	(6)	83	(6)	100	(6)
ALPHA-BHC	0	(6)	17	(6)	0	(6)	0	(6)
ANTIMONY	0	(6)	0	(6)	100	(6)	100	(6)
ARSENIC	0	(6)	0	(6)	100	(6)	100	(6)
BERYLLIUM	0	(6)	0	(6)	100	(6)	100	(6)
SELENIUM	0	(6)	0	(6)	100	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 5

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMB. SLUDGE	DIGESTED SLUDGE
CONVENTIONALS	BOD	MG/L	138	13	91	15671	3182
	TOTAL SUSP. SOLIDS	MG/L	147	12	92	26433	17438
	COD	MG/L	374	68	82	35283	12712
	OIL & GREASE	MG/L	33	3	91	4188	2746
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	30	8	73	99	258
	TOTAL SOLIDS	MG/L	889	695	22	29864	18407
	TOTAL DISS. SOLIDS	MG/L	742	683	8	3431	1016
	SETTLEABLE SOLIDS	ML/L	7	L 1	86	992	860
	TOTAL VOLATILE SOLIDS	MG/L	480	371	23	657	161
	VOLATILE DISS. SOLIDS	MG/L	360	360		2426	359
	TOTAL VOL. SUS. SOLIDS	MG/L	120	11	91	19182	8362
	AMMONIA NITROGEN	MG/L	12	7	42	35	419
	TOC	MG/L	64	14	78	7527	1275
VOLATILES	BENZENE	UG/L	5	1	80	42	5
	CHLOROBENZENE	UG/L	0	1		N-D	1
	1,1,1-TRICHLOROETHANE	UG/L	19	3	84	N-D	2
	1,1,2,2-TETRACHLOROETHANE	UG/L	1	L 1		40	45
	2-CHLOROETHYL VINYL ETHER	UG/L	L 8	L 8		N-D	0
	CHLOROFORM	UG/L	12	7	42	2	6
	1,1-DICHLOROETHYLENE	UG/L	0	L 1		22	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	2	L 2		1541	22
	1,2-DICHLOROPROPANE	UG/L	0	L 1		8	N-D
	1,3-DICHLOROPROPYLENE	UG/L	4	L 2	50	N-D	N-D
	ETHYLBENZENE	UG/L	10	1	90	166	73
	METHYLENE CHLORIDE	UG/L	676	468	31	101	11
	METHYL CHLORIDE	UG/L	L 34	L 34		45	9
	DICHLOROBROMOMETHANE	UG/L	3	2	33	N-D	N-D
	CHLORODIBROMOMETHANE	UG/L	1	1		3	1
	TETRACHLOROETHYLENE	UG/L	115	26	77	14	N-D
	TOLUENE	UG/L	37	0	100	199	124
	TRICHLOROETHYLENE	UG/L	49	14	71	163	2
	VINYL CHLORIDE	UG/L	L 33	L 33		3292	117
ACID EXTRACT	2,4-DICHLOROPHENOL	UG/L	L 1	L 1		N-D	4
	2,4-DIMETHYLPHENOL	UG/L	0	L 1		N-D	N-D
	PENTACHLOROPHENOL	UG/L	L 5	L 5		N-D	5
	PHENOL	UG/L	1	0	100	27	48
BASE-NEUTRALS	ACENAPHTHENE	UG/L	L 4	L 4		20	13
	1,2-DICHLOROBENZENE	UG/L	L 5	L 5		3	N-D
	1,4-DICHLOROBENZENE	UG/L	L 5	L 5		15	6
	FLUORANTHENE	UG/L	L 3	L 3		N-D	10
	NAPHTHALENE	UG/L	3	L 3		118	32
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	28	6	79	3598	4170
	BUTYL BENZYL PHTHALATE	UG/L	6	L 2	67	450	152
	DI-N-BUTYL PHTHALATE	UG/L	3	L 2	33	N-D	N-D
	DI-N-OCTYL PHTHALATE	UG/L	L 4	L 4		47	48
	DIETHYL PHTHALATE	UG/L	2	L 2		N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 5

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMB. SLUDGE	DIGESTED SLUDGE
BASE-NEUTRALS	ANTHRACENE	UG/L	L 3	L 3		92	102
	PHENANTHRENE	UG/L	L 3	L 3		92	102
	PYRENE	UG/L	L 2	L 2		10	9
PESTICIDES	BETA-BHC	NG/L	L 1000	12		L 1000	L 1000
	GAMMA-BHC	NG/L	L 1000	55		L 1000	L 1000
METALS	ANTIMONY	UG/L	L 50	L 50		55	52
	ARSENIC	UG/L	L 50	L 50		78	69
	BERYLLIUM	UG/L	1	L 2		6	6
	CADMIUM	UG/L	6	1	83	385	312
	CHROMIUM	UG/L	102	35	66	8317	7767
	COPPER	UG/L	70	31	56	3000	2767
	CYANIDE	UG/L	12	5	58	221	28
	LEAD	UG/L	67	4	94	8967	9167
	NICKEL	UG/L	12	L 10	17	1077	1240
	SELENIUM	UG/L	L 50	L 50		53	41
	SILVER	UG/L	23	2	91	1103	800
	ZINC	UG/L	248	66	73	23833	24167
NON-CONV. METALS	ALUMINUM	UG/L	817	155	81	NOT RUN	NOT RUN
	BARIUM	UG/L	101	54	47	NOT RUN	NOT RUN
	CALCIUM	MG/L	74	70	5	NOT RUN	NOT RUN
	IRON	UG/L	1192	274	77	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	28	27	4	NOT RUN	NOT RUN
	MANGANESE	UG/L	234	203	13	NOT RUN	NOT RUN
	SODIUM	MG/L	89	87	2	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 5

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	COMBINED SLUDGE
CONVENTIONALS	BOD	24890	6755	2249	4506	11749
	TOTAL SUSP. SOLIDS	26449	26883	2189	24694	19817
	COD	67323	30296	12295	18001	26452
	OIL & GREASE	5938	4338	450	3888	3139
NON-CONVENTIONALS	TOTAL PHENOLS	5.4	1.8	1.4	.4	L 0.1
	TOTAL SOLIDS	159956	151175	125110	26065	22389
	TOTAL DISS. SOLIDS	133507	124359	122921	1438	2572
	TOTAL VOLATILE SOLIDS	86365	66981	66753	228	492
	VOLATILE DISS. SOLIDS	64774	65222	64714	508	1819
	TOTAL VOL. SUS. SOLIDS	21591	13850	2009	11841	14380
	AMMONIA NITROGEN	2159	1912	1319	593	25.9
	TOC	11455	4355	2549	1806	5643
VOLATILES	BENZENE	1.0	L 0.1	L 0.1	L 0.1	L 0.1
	CHLOROBENZENE	L 0.1	L 0.1	L 0.1	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	3.4	.5	.5	L 0.1	N-D
	1,1,2,2-TETRACHLOROETHANE	.2	L 0.1	N-D	L 0.1	L 0.1
	2-CHLOROETHYL VINYL ETHER	N-D	L 0.1	N-D	L 0.1	N-D
	CHLOROFORM	2.2	1.3	1.3	L 0.1	L 0.1
	1,1-DICHLOROETHYLENE	L 0.1	N-D	N-D	N-D	L 0.1
	1,2-TRANS-DICHLOROETHYLENE	.4	L 0.1	N-D	L 0.1	1.2
	1,2-DICHLOROPROPANE	L 0.1	N-D	N-D	N-D	L 0.1
	1,3-DICHLOROPROPYLENE	.7	N-D	N-D	N-D	N-D
	ETHYLBENZENE	1.9	.2	L 0.1	.1	.1
	METHYLENE CHLORIDE	122	84.3	84.3	L 0.1	L 0.1
	METHYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	L 0.1
	DICHLOROBROMOMETHANE	.5	.4	.4	N-D	N-D
	CHLORODIBROMOMETHANE	.1	.1	.1	L 0.1	L 0.1
	TETRACHLOROETHYLENE	20.7	4.6	4.6	N-D	L 0.1
	TOLUENE	6.7	.3	L 0.1	.2	.1
	TRICHLOROETHYLENE	8.8	2.5	2.5	L 0.1	.1
	VINYL CHLORIDE	N-D	.2	N-D	.2	2.5
ACID EXTRACT	2,4-DICHLOROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	2,4-DIMETHYLPHENOL	L 0.1	N-D	N-D	N-D	N-D
	PENTACHLOROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	PHENOL	.1	L 0.1	L 0.1	L 0.1	L 0.1
BASE-NEUTRALS	ACENAPHTHENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,2-DICHLOROBENZENE	N-D	N-D	N-D	N-D	L 0.1
	1,4-DICHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	NAPHTHALENE	.6	L 0.1	N-D	L 0.1	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	5.0	7.0	1.1	5.9	2.7
	BUTYL BENZYL PHTHALATE	1.0	.2	N-D	.2	.3
	DI-N-BUTYL PHTHALATE	.5	N-D	N-D	N-D	N-D
	DI-N-OCTYL PHTHALATE	N-D	L 0.1	N-D	L 0.1	L 0.1
	DIETHYL PHTHALATE	.3	N-D	N-D	N-D	N-D

SECONDARY TREATMENT SYSTEM ONLY
SLUDGE FLOWS ADJUSTED TO APPROXIMATE FLOW UNDERGOING SECONDARY TRATMENT ONLY
COMBINED SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 5

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	COMBINED SLUDGE
BASE-NEUTRALS	ANTHRACENE	N-D	.1	N-D	.1	L 0.1
	PHENANTHRENE	N-D	.1	N-D	.1	L 0.1
	PYRENE	N-D	L 0.1	N-D	L 0.1	L 0.1
PESTICIDES	BETA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1	L 0.1
	ARSENIC	N-D	L 0.1	N-D	L 0.1	L 0.1
	BERYLLIUM	.2	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	1.0	.5	.1	.4	.3
	CHROMIUM	18.4	17.3	6.3	11.0	6.2
	COPPER	12.6	9.5	5.6	3.9	2.2
	CYANIDE	2.1	.9	.9	L 0.1	.2
	LEAD	12.1	13.7	.7	13.0	6.7
	NICKEL	2.1	1.8	N-D	1.8	.8
	SELENIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	SILVER	4.2	1.4	.3	1.1	.8
	ZINC	44.5	46.0	11.8	34.2	17.9
NON-CONV. METALS	ALUMINUM	147	-	27.9	NOT RUN	NOT RUN
	BARIUM	18.1	-	9.6	NOT RUN	NOT RUN
	CALCIUM	13225	-	12535	NOT RUN	NOT RUN
	IRON	215	-	49.2	NOT RUN	NOT RUN
	MAGNESIUM	4948	-	4768	NOT RUN	NOT RUN
	MANGANESE	42.2	-	36.6	NOT RUN	NOT RUN
	SODIUM	16014	-	15684	NOT RUN	NOT RUN

SECONDARY TREATMENT SYSTEM ONLY
SLUDGE FLOWS ADJUSTED TO APPROXIMATE FLOW UNDERGOING SECONDARY TRATMENT ONLY
COMBINED SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 5

PARAMETER	INFLUENT		SECONDARY EFFLUENT		COMBINED SLUDGE		DIGESTED SLUDGE	
BENZENE	100	(6)	50	(6)	100	(6)	67	(6)
1,1,1-TRICHLOROETHANE	100	(6)	67	(6)	0	(6)	17	(6)
CHLOROFORM	100	(6)	100	(6)	33	(6)	33	(6)
1,2-TRANS-DICHLOROETHYLENE	100	(6)	0	(6)	100	(6)	83	(6)
ETHYLBENZENE	100	(6)	33	(6)	100	(6)	100	(6)
METHYLENE CHLORIDE	100	(6)	100	(6)	83	(6)	83	(6)
DICHLOROBROMOMETHANE	100	(6)	83	(6)	0	(6)	0	(6)
TETRACHLOROETHYLENE	100	(6)	100	(6)	33	(6)	0	(6)
TOLUENE	100	(6)	33	(6)	100	(6)	100	(6)
TRICHLOROETHYLENE	100	(6)	100	(6)	83	(6)	33	(6)
BIS(2-ETHYLHEXYL) PHTHALATE	100	(6)	100	(6)	100	(6)	100	(6)
BUTYL BENZYL PHTHALATE	100	(6)	0	(6)	33	(6)	17	(6)
CADMIUM	100	(6)	17	(6)	100	(6)	100	(6)
CHROMIUM	100	(6)	100	(6)	100	(6)	100	(6)
COPPER	100	(6)	100	(6)	100	(6)	100	(6)
CYANIDE	100	(6)	83	(6)	100	(6)	100	(6)
LEAD	100	(6)	17	(6)	100	(6)	100	(6)
SILVER	100	(6)	33	(6)	100	(6)	100	(6)
ZINC	100	(6)	100	(6)	100	(6)	100	(6)
PHENOL	83	(6)	17	(6)	33	(6)	17	(6)
1,3-DICHLOROPROPYLENE	67	(6)	0	(6)	0	(6)	0	(6)
NAPHTHALENE	50	(6)	0	(6)	50	(6)	33	(6)
DI-N-BUTYL PHTHALATE	50	(6)	0	(6)	0	(6)	0	(6)
DIETHYL PHTHALATE	50	(6)	0	(6)	0	(6)	0	(6)
NICKEL	50	(6)	0	(6)	100	(6)	100	(6)
1,1,2,2-TETRACHLOROETHANE	33	(6)	0	(6)	20	(5)	75	(4)
CHLORODIBROMOMETHANE	33	(6)	33	(6)	20	(5)	17	(6)
2,4-DIMETHYLPHENOL	33	(6)	0	(6)	0	(6)	0	(6)
BERYLLIUM	33	(6)	0	(6)	100	(6)	100	(6)
CHLOROBENZENE	17	(6)	33	(6)	0	(6)	17	(6)
1,1-DICHLOROETHYLENE	17	(6)	0	(6)	33	(6)	0	(6)
1,2-DICHLOROPROPANE	17	(6)	0	(6)	33	(6)	0	(6)
2-CHLOROETHYL VINYL ETHER	0	(6)	0	(6)	0	(6)	17	(6)
METHYL CHLORIDE	0	(6)	0	(6)	100	(6)	67	(6)
VINYL CHLORIDE	0	(6)	0	(6)	50	(6)	17	(6)
2,4-DICHLOROPHENOL	0	(6)	0	(6)	0	(6)	17	(6)
PENTACHLOROPHENOL	0	(6)	0	(6)	0	(6)	17	(6)
ACENAPHTHENE	0	(6)	0	(6)	17	(6)	33	(6)
1,2-DICHLOROBENZENE	0	(6)	0	(6)	17	(6)	0	(6)
1,4-DICHLOROBENZENE	0	(6)	0	(6)	33	(6)	17	(6)
FLUORANTHENE	0	(6)	0	(6)	0	(6)	17	(6)
DI-N-OCTYL PHTHALATE	0	(6)	0	(6)	33	(6)	17	(6)
ANTHRACENE	0	(6)	0	(6)	67	(6)	83	(6)
PHENANTHRENE	0	(6)	0	(6)	67	(6)	83	(6)
PYRENE	0	(6)	0	(6)	33	(6)	17	(6)
BETA-BHC	0	(6)	17	(6)	0	(6)	0	(6)
GAMMA-BHC	0	(6)	50	(6)	0	(6)	0	(6)
ANTIMONY	0	(6)	0	(6)	60	(5)	100	(6)
ARSENIC	0	(6)	0	(6)	100	(6)	100	(6)
SELENIUM	0	(6)	0	(6)	100	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 6

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	RCNT REM.	PRIMARY SLUDGE	DIGESTED SLUDGE
CONVENTIONALS	BOD	MG/L	263	18	93	16857	16856
	TOTAL SUSP. SOLIDS	MG/L	632	27	96	51342	47758
	COD	MG/L	904	131	86	55386	51787
	OIL & GREASE	MG/L	54	2	96	4938	4948
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	309	38	88	4672	7420
	TOTAL SOLIDS	MG/L	1370	683	50	53717	49232
	TOTAL DISS. SOLIDS	MG/L	678	646	5	4618	1140
	SETTLEABLE SOLIDS	ML/L	493	17	97	1625	1775
	TOTAL VOLATILE SOLIDS	MG/L	676	132	81	41398	37562
	VOLATILE DISS. SOLIDS	MG/L	161	117	27	362	445
	TOTAL VOL. SUS. SOLIDS	MG/L	530	18	97	41017	37250
	AMMONIA NITROGEN	MG/L	20	12	40	82	585
	TOC	MG/L	391	40	90	24006	25625
VOLATILES	BENZENE	UG/L	1	0	100	12	11
	CARBON TETRACHLORIDE	UG/L	L 2	L 2		10	N-D
	CHLOROBENZENE	UG/L	L 1	L 1		6	0
	1,2-DICHLOROETHANE	UG/L	11	1	91	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	417	47	89	33	N-D
	1,1-DICHLOROETHANE	UG/L	5	1	88	212	N-D
	1,1,2-TRICHLOROETHANE	UG/L	1	L 2		N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		N-D	1
	CHLOROETHANE	UG/L	L 15	L 15		167	1800
	CHLOROFORM	UG/L	6	3	50	N-D	N-D
	1,1-DICHLOROETHYLENE	UG/L	43	0	100	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	35	9	77	676	116
	ETHYLBENZENE	UG/L	1	L 1		317	392
	METHYLENE CHLORIDE	UG/L	32	23	28	64	25
	METHYL CHLORIDE	UG/L	33	L 34		N-D	N-D
	DICHLOROBROMOMETHANE	UG/L	1	0	100	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	6	6		N-D	N-D
	TETRACHLOROETHYLENE	UG/L	9	0	100	58	52
	TOLUENE	UG/L	191	20	90	475	423
	TRICHLOROETHYLENE	UG/L	487	64	87	32	4
	VINYL CHLORIDE	UG/L	1696	101	94	34000	33800
ACID EXTRACT	PARACHLOROMETA CRESOL	UG/L	9	1	89	N-D	N-D
	2,4-DICHLOROPHENOL	UG/L	1	L 1		N-D	N-D
	PENTACHLOROPHENOL	UG/L	15	2	87	N-D	N-D
	PHENOL	UG/L	1	0	100	882	1833

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 6

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	DIGESTED SLUDGE
BASE-NEUTRALS	ACENAPHTHENE	UG/L	1	1		N-D	N-D
	1,3-DICHLOROBENZENE	UG/L	3	L 1	67	N-D	N-D
	1,4-DICHLOROBENZENE	UG/L	1	L 1		N-D	N-D
	2,4-DINITROTOLUENE	UG/L	1	1		N-D	N-D
	NAPHTHALENE	UG/L	1	L 2		N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	64	9	86	5200	4086
	BUTYL BENZYL PHTHALATE	UG/L	L 5	0		1500	N-D
	DI-N-BUTYL PHTHALATE	UG/L	38	11	71	543	N-D
	DIETHYL PHTHALATE	UG/L	15	2	87	N-D	N-D
	1,2-BENZANTHRACENE	UG/L	L 5	1		565	62
	CHRYSENE	UG/L	L 5	1		565	62
	ANTHRACENE	UG/L	52	11	79	1505	994
	1,12-BENZOPERYLENE	UG/L	6	1	83	N-D	N-D
	FLUORENE	UG/L	L 5	0		N-D	N-D
	PHENANTHRENE	UG/L	52	11	79	1505	994
METALS	ANTIMONY	UG/L	L 50	L 50		393	350
	ARSENIC	UG/L	L 50	L 50		313	212
	BERYLLIUM	UG/L	L 2	L 2		11	9
	CADMIUM	UG/L	1076	65	94	82500	79833
	CHROMIUM	UG/L	1390	62	96	74333	73833
	COPPER	UG/L	766	47	94	51333	46000
	CYANIDE	UG/L	99	389		22123	17597
	LEAD	UG/L	195	18	91	16167	9667
	MERCURY	NG/L	3233	200	94	601667	486667
	NICKEL	UG/L	701	294	58	17000	17500
	SELENIUM	UG/L	L 50	L 50		162	152
	SILVER	UG/L	15	3	80	623	802
	ZINC	UG/L	4935	475	90	386667	365000
NON-CONV. METALS	ALUMINUM	UG/L	2380	134	94	NOT RUN	NOT RUN
	BARIUM	UG/L	302	31	90	NOT RUN	NOT RUN
	CALCIUM	MG/L	56	46	18	NOT RUN	NOT RUN
	IRON	UG/L	7363	421	94	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	15	13	13	NOT RUN	NOT RUN
	MANGANESE	UG/L	265	151	47	NOT RUN	NOT RUN
	SODIUM	MG/L	141	134	5	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 6

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	PRIMARY SLUDGE
CONVENTIONALS	BOD	15467	3605	1078	2527	5655
	TOTAL SUSP. SOLIDS	37148	8729	1568	7161	15396
	COD	53164	15469	7704	7765	16609
	OIL & GREASE	3186	869	127	742	1496
NON-CONVENTIONALS	TOTAL PHENOLS	18.2	3.3	2.2	1.1	1.4
	TOTAL SOLIDS	80569	47520	40138	7382	16109
	TOTAL DISS. SOLIDS	39844	38143	37972	171	1385
	TOTAL VOLATILE SOLIDS	39844	13390	7743	5647	12415
	VOLATILE DISS. SOLIDS	9459	6948	6881	66.7	114
	TOTAL VOL. SUS. SOLIDS	31169	6663	1078	5585	12300
	AMMONIA NITROGEN	1157	794	706	87.7	24.5
	TOC	22965	6175	2333	3842	7200
VOLATILES	BENZENE	L 0.1	L 0.1	L 0.1	L 0.1	L 0.1
	CARBON TETRACHLORIDE	N-D	N-D	N-D	N-D	L 0.1
	CHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,2-DICHLOROETHANE	.6	L 0.1	L 0.1	N-D	N-D
	1,1,1-TRICHLOROETHANE	24.5	2.8	2.8	N-D	L 0.1
	1,1-DICHLOROETHANE	.5	L 0.1	L 0.1	N-D	L 0.1
	1,1,2-TRICHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	CHLOROETHANE	N-D	.3	N-D	.3	L 0.1
	CHLOROFORM	.3	.2	.2	N-D	N-D
	1,1-DICHLOROETHYLENE	2.5	L 0.1	L 0.1	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	2.1	.4	.4	L 0.1	.3
	ETHYLBENZENE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	METHYLENE CHLORIDE	1.9	1.3	1.3	L 0.1	L 0.1
	METHYL CHLORIDE	2.0	N-D	N-D	N-D	N-D
	DICHLOROBROMOMETHANE	L 0.1	L 0.1	L 0.1	N-D	N-D
	TRICHLOROFLUOROMETHANE	.3	.4	.4	N-D	N-D
	TETRACHLOROETHYLENE	.5	L 0.1	L 0.1	L 0.1	L 0.1
	TOLUENE	11.2	1.3	1.2	L 0.1	.1
	TRICHLOROETHYLENE	28.6	3.8	3.8	L 0.1	L 0.1
	VINYL CHLORIDE	99.9	11.0	5.9	5.1	10.2
ACID EXTRACT	PARACHLOROMETA CRESOL	.5	L 0.1	L 0.1	N-D	N-D
	2,4-DICHLOROPHENOL	L 0.1	N-D	N-D	N-D	N-D
	PENTACHLOROPHENOL	.9	L 0.1	L 0.1	N-D	N-D
	PHENOL	L 0.1	.3	L 0.1	.3	.3
BASE-NEUTRALS	ACENAPHTHENE	L 0.1	L 0.1	L 0.1	N-D	N-D
	1,3-DICHLOROBENZENE	.1	N-D	N-D	N-D	N-D
	1,4-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D	N-D
	2,4-DINITROTOLUENE	L 0.1	L 0.1	L 0.1	N-D	N-D
	NAPHTHALENE	L 0.1	N-D	N-D	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	3.8	1.1	.5	.6	1.6
	BUTYL BENZYL PHTHALATE	N-D	L 0.1	L 0.1	N-D	.4
	DI-N-BUTYL PHTHALATE	2.2	.6	.6	N-D	.2
	DIETHYL PHTHALATE	.9	.1	.1	N-D	N-D
	1,2-BENZANTHRACENE	N-D	L 0.1	L 0.1	L 0.1	.2

PRIMARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 6

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	DIGESTED SLUDGE	PRIMARY SLUDGE
BASE-NEUTRALS	CHRYSENE	N-D	L 0.1	L 0.1	L 0.1	.2
	ANTHRACENE	3.0	.7	.6	.1	.5
	1,12-BENZOPERYLENE	.3	L 0.1	L 0.1	N-D	N-D
	FLUORENE	N-D	L 0.1	L 0.1	N-D	N-D
	PHENANTHRENE	3.0	.7	.6	.1	.5
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1	.1
	ARSENIC	N-D	L 0.1	N-D	L 0.1	L 0.1
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	63.3	15.8	3.8	12.0	24.7
	CHROMIUM	81.8	14.7	3.6	11.1	22.3
	COPPER	44.7	9.7	2.8	6.9	15.4
	CYANIDE	5.8	25.5	22.9	2.6	6.6
	LEAD	11.7	2.5	1.1	1.4	4.8
	MERCURY	.2	L 0.1	L 0.1	L 0.1	.2
	NICKEL	41.2	19.9	17.3	2.6	5.1
	SELENIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	SILVER	.9	.3	.2	.1	.2
	ZINC	290	82.6	27.9	54.7	116
NON-CONV. METALS	ALUMINUM	140	-	7.9	NOT RUN	NOT RUN
	BARIUM	17.8	-	1.8	NOT RUN	NOT RUN
	CALCIUM	3284	-	2725	NOT RUN	NOT RUN
	IRON	433	-	24.8	NOT RUN	NOT RUN
	MAGNESIUM	882	-	765	NOT RUN	NOT RUN
	MANGANESE	16.8	-	8.9	NOT RUN	NOT RUN
	SODIUM	8312	-	7861	NOT RUN	NOT RUN

PRIMARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 6

PARAMETER	INFLUENT		SECONDARY EFFLUENT		PRIMARY SLUDGE		DIGESTED SLUDGE	
1,2-TRANS-DICHLOROETHYLENE	100	(6)	100	(6)	67	(6)	100	(6)
METHYLENE CHLORIDE	100	(6)	100	(6)	67	(6)	83	(6)
METHYL CHLORIDE	100	(6)	0	(6)	0	(6)	0	(6)
TETRACHLOROETHYLENE	100	(6)	33	(6)	100	(6)	100	(6)
TOLUENE	100	(6)	100	(6)	100	(6)	100	(6)
TRICHLOROETHYLENE	100	(6)	100	(6)	83	(6)	33	(6)
VINYL CHLORIDE	100	(6)	100	(6)	100	(6)	100	(6)
PENTACHLOROPHENOL	100	(6)	33	(6)	0	(6)	0	(6)
BIS(2-ETHYLHEXYL) PHTHALATE	100	(6)	83	(6)	100	(6)	100	(5)
CADMIUM	100	(6)	100	(6)	100	(6)	100	(6)
CHROMIUM	100	(6)	100	(6)	100	(6)	100	(6)
COPPER	100	(6)	100	(6)	100	(6)	100	(6)
CYANIDE	100	(6)	67	(6)	100	(6)	100	(6)
LEAD	100	(6)	67	(6)	100	(6)	100	(6)
MERCURY	100	(6)	83	(6)	100	(6)	100	(6)
NICKEL	100	(6)	100	(6)	100	(6)	100	(6)
SILVER	100	(6)	17	(6)	100	(6)	100	(6)
ZINC	100	(6)	100	(6)	100	(6)	100	(6)
1,1,1-TRICHLOROETHANE	83	(6)	100	(6)	33	(6)	0	(6)
1,1-DICHLOROETHANE	83	(6)	67	(6)	83	(6)	0	(6)
CHLOROFORM	83	(6)	100	(6)	0	(6)	0	(6)
ANTHRACENE	83	(6)	83	(6)	100	(6)	80	(5)
PHENANTHRENE	83	(6)	83	(6)	100	(6)	80	(5)
BENZENE	67	(6)	17	(6)	100	(6)	67	(6)
1,1-DICHLOROETHYLENE	67	(6)	17	(6)	0	(6)	0	(6)
TRICHLOROFLUOROMETHANE	67	(6)	83	(6)	0	(6)	0	(6)
PARACHLOROMETA CRESOL	67	(6)	50	(6)	0	(6)	0	(6)
DIETHYL PHTHALATE	67	(6)	50	(6)	0	(6)	0	(5)
DI-N-BUTYL PHTHALATE	50	(6)	83	(6)	67	(6)	0	(5)
1,2-DICHLOROETHANE	33	(6)	17	(6)	0	(6)	0	(6)
ETHYLBENZENE	33	(6)	0	(6)	100	(6)	100	(6)
DICHLOROBROMOMETHANE	33	(6)	33	(6)	0	(6)	0	(6)
PHENOL	33	(6)	33	(6)	100	(6)	100	(6)
1,1,2-TRICHLOROETHANE	17	(6)	0	(6)	0	(6)	0	(6)
2,4-DICHLOROPHENOL	17	(6)	0	(6)	0	(6)	0	(6)
ACENAPHTHENE	17	(6)	50	(6)	0	(6)	0	(5)
1,3-DICHLOROBENZENE	17	(6)	0	(6)	0	(6)	0	(5)
1,4-DICHLOROBENZENE	17	(6)	0	(6)	0	(6)	0	(5)
2,4-DINITROTOLUENE	17	(6)	33	(6)	0	(6)	0	(5)
NAPHTHALENE	17	(6)	0	(6)	0	(6)	0	(5)
1,12-BENZOPERYLENE	17	(6)	17	(6)	0	(6)	0	(5)
CARBON TETRACHLORIDE	0	(6)	0	(6)	17	(6)	0	(6)
CHLOROBENZENE	0	(6)	0	(6)	17	(6)	17	(6)
1,1,2,2-TETRACHLOROETHANE	0	(6)	0	(6)	0	(6)	17	(6)
CHLOROETHANE	0	(6)	0	(6)	17	(6)	67	(6)
BUTYL BENZYL PHTHALATE	0	(6)	17	(6)	83	(6)	0	(5)
1,2-BENZANTHRACENE	0	(6)	33	(6)	100	(6)	20	(5)
CHRYSENE	0	(6)	33	(6)	100	(6)	20	(5)
FLUORENE	0	(6)	17	(6)	0	(6)	0	(5)
ANTIMONY	0	(6)	0	(6)	100	(6)	100	(6)
ARSENIC	0	(6)	0	(6)	100	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 6

PARAMETER	INFLUENT		SECONDARY EFFLUENT		PRIMARY SLUDGE		DIGESTED SLUDGE	
BERYLLIUM	0	(6)	0	(6)	100	(6)	100	(6)
SELENIUM	0	(6)	0	(6)	100	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 7

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
CONVENTIONALS	BOD	MG/L	165	29	83	27464	29313	13964
	TOTAL SUSP. SOLIDS	MG/L	135	13	87	35057	26315	2877
	COD	MG/L	328	97	70	52081	57722	20116
	OIL & GREASE	MG/L	41	9	78	7983	9669	533
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	55	8	85	1133	3512	4122
	TOTAL SOLIDS	MG/L	862	845	2	41246	34323	14116
	TOTAL DISS. SOLIDS	MG/L	718	831		4262	9576	11239
	SETTLEABLE SOLIDS	ML/L	3	L 1	67	670	345	33
	TOTAL VOLATILE SOLIDS	MG/L	329	284	14	27934	23131	11496
	VOLATILE DISS. SOLIDS	MG/L	225	271		2243	7551	9881
	TOTAL VOL. SUS. SOLIDS	MG/L	105	14	87	22103	15217	1615
	AMMONIA NITROGEN	MG/L	13	14		257	515	435
	TOC	MG/L	65	24	63	9050	8433	8767
VOLATILES	BENZENE	UG/L	1	L 5		95	507	22
	CHLOROBENZENE	UG/L	L 5	L 5		6	1	0
	1,1,1-TRICHLOROETHANE	UG/L	49	7	86	N-D	N-D	L 5
	1,1-DICHLOROETHANE	UG/L	1	L 5		352	N-D	L 5
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 5	L 5		26	N-D	L 5
	CHLOROFORM	UG/L	5	1	80	7	N-D	L 5
	1,2-TRANS-DICHLOROETHYLENE	UG/L	2	3		1517	285	9
	1,2-DICHLOROPROPANE	UG/L	L 5	L 5		N-D	6	L 5
	1,3-DICHLOROPROPYLENE	UG/L	L 5	L 5		N-D	55	L 5
	ETHYLBENZENE	UG/L	22	L 5	77	2150	465	13
	METHYLENE CHLORIDE	UG/L	36	23	36	8	1	35
	DICHLORODIFLUOROMETHANE	UG/L	L 5	L 5		32	N-D	L 5
	TETRACHLOROETHYLENE	UG/L	15	3	80	1	15	L 5
	TOLUENE	UG/L	15	1	93	4615	2343	63
	TRICHLOROETHYLENE	UG/L	17	4	76	2	7	L 5
ACID EXTRACT	PENTACHLOROPHENOL	UG/L	L 27	L 250		1000	N-D	L 250
	PHENOL	UG/L	15	L 300		173	1717	907
BASE-NEUTRALS	1,2-DICHLOROBENZENE	UG/L	3	L 11		233	50	17
	1,3-DICHLOROBENZENE	UG/L	L 11	L 11		35	N-D	L 100
	1,4-DICHLOROBENZENE	UG/L	L 11	L 11		28	10	L 100
	FLUORANTHENE	UG/L	L 5	L 11		143	13	L 50
	NAPHTHALENE	UG/L	6	L 11		185	16	2

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 7

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
BASE-NEUTRALS	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	217	90	59	11257	10117	1498
	BUTYL BENZYL PHTHALATE	UG/L	7	L 11		1162	735	L 100
	DI-N-BUTYL PHTHALATE	UG/L	3	L 11		315	265	L 100
	DIETHYL PHTHALATE	UG/L	7	L 11		N-D	N-D	L 100
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		153	25	L 50
	CHRYSENE	UG/L	L 5	L 5		153	25	L 50
	ANTHRACENE	UG/L	L 11	L 11		627	407	L 100
	PHENANTHRENE	UG/L	L 11	L 11		627	407	L 100
	PYRENE	UG/L	L 5	L 5		160	14	L 50
PESTICIDES	HEPTACHLOR	NG/L	417	L 1000		L 1000	L 1000	333
	HEPTACHLOR EPOXIDE	NG/L	63	83		L 1000	L 1000	63
	GAMMA-BHC	NG/L	500	500		L 1000	L 1000	167
	DELTA-BHC	NG/L	83	L 1000		L 1000	L 1000	L 1000
METALS	ANTIMONY	UG/L	6	3	50	1403	1047	54
	ARSENIC	UG/L	L 3	L 3		332	207	56
	BERYLLIUM	UG/L	0	3		L 10	L 10	1
	CADMIUM	UG/L	5	5		499	313	139
	CHROMIUM	UG/L	289	52	82	72667	56000	9569
	COPPER	UG/L	223	39	83	45633	35333	5701
	CYANIDE	UG/L	42	24	43	2503	278	49
	LEAD	UG/L	72	47	35	44167	6133	1701
	MERCURY	NG/L	1000	1000		205000	140500	1000
	NICKEL	UG/L	345	325	6	27333	20667	9288
	SELENIUM	UG/L	L 3	L 3		153	93	6
	SILVER	UG/L	5	1	80	177	165	27
	THALLIUM	UG/L	L 25	L 25		L 10	L 10	52
	ZINC	UG/L	619	108	83	125333	98833	32602
NON-CONV. METALS	ALUMINUM	UG/L	464	37	91	NOT RUN	NOT RUN	15523
	BARIUM	UG/L	84	23	73	NOT RUN	NOT RUN	935
	BORON	UG/L	759	757		NOT RUN	NOT RUN	1055
	CALCIUM	MG/L	74	72	3	NOT RUN	NOT RUN	306
	COBALT	UG/L	11	10	9	NOT RUN	NOT RUN	190
	IRON	UG/L	3463	407	88	NOT RUN	NOT RUN	46061
	MAGNESIUM	MG/L	20	19	5	NOT RUN	NOT RUN	70
	MANGANESE	UG/L	62	60	3	NOT RUN	NOT RUN	1104
	MOLYBDENUM	UG/L	17	15	12	NOT RUN	NOT RUN	154

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 7

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
NON-CONV. METALS	SODIUM	MG/L	131	130	1	NOT RUN	NOT RUN	164
	TIN	UG/L	23	13	43	NOT RUN	NOT RUN	391
	TITANIUM	UG/L	7	4	43	NOT RUN	NOT RUN	171
	VANADIUM	UG/L	142	132	7	NOT RUN	NOT RUN	662
	YTTRIUM	UG/L	3	3		NOT RUN	NOT RUN	18

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 7

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	HEAT TREATED SLUDGE
CONVENTIONALS	BOD	68350	124447	11577	112870	48336
	TOTAL SUSP. SOLIDS	54518	151127	7160	143967	43838
	COD	132922	252959	39080	213879	96499
	OIL & GREASE	16396	36532	3747	32785	16007
NON-CONVENTIONALS	TOTAL PHENOLS	22.3	7.9	3.2	4.7	5.9
	TOTAL SOLIDS	348970	510270	340879	169391	58014
	TOTAL DISS. SOLIDS	290674	351219	333718	17501	15958
	TOTAL VOLATILE SOLIDS	133327	228746	114028	114718	38537
	VOLATILE DISS. SOLIDS	91021	117816	108607	9209	12630
	TOTAL VOL. SUS. SOLIDS	42306	96192	5420	90772	25351
	AMMONIA NITROGEN	5060	6475	5420	1055	859
	TOC	26180	46735	9569	37166	14050
VOLATILES	BENZENE	.5	.4	N-D	.4	.8
	CHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,1,1-TRICHLOROETHANE	19.7	2.7	2.7	N-D	N-D
	1,1-DICHLOROETHANE	.3	1.4	N-D	1.4	N-D
	1,1,2,2-TETRACHLOROETHANE	N-D	.1	N-D	.1	N-D
	CHLOROFORM	1.9	.5	.5	L 0.1	N-D
	1,2-TRANS-DICHLOROETHYLENE	.8	7.4	1.2	6.2	.5
	1,2-DICHLOROPROPANE	N-D	N-D	N-D	N-D	L 0.1
	1,3-DICHLOROPROPYLENE	N-D	N-D	N-D	N-D	L 0.1
	ETHYLBENZENE	8.8	8.6	N-D	8.6	.8
	METHYLENE CHLORIDE	14.5	9.4	9.4	L 0.1	L 0.1
	DICHLORODIFLUOROMETHANE	N-D	.1	N-D	.1	N-D
	TETRACHLOROETHYLENE	6.2	1.3	1.3	L 0.1	L 0.1
	TOLUENE	6.2	19.3	.3	19.0	3.9
	TRICHLOROETHYLENE	6.9	1.5	1.5	L 0.1	L 0.1
ACID EXTRACT	PENTACHLOROPHENOL	N-D	4.1	N-D	4.1	N-D
	PHENOL	5.9	.7	N-D	.7	2.9
BASE-NEUTRALS	1,2-DICHLOROBENZENE	1.4	1.0	N-D	1.0	L 0.1
	1,3-DICHLOROBENZENE	N-D	.1	N-D	.1	N-D
	1,4-DICHLOROBENZENE	N-D	.1	N-D	.1	L 0.1
	FLUORANTHENE	N-D	.6	N-D	.6	L 0.1
	NAPHTHALENE	3.4	.7	N-D	.7	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	87.7	82.3	36.1	46.2	16.9
	BUTYL BENZYL PHTHALATE	2.7	4.8	N-D	4.8	1.2
	DI-N-BUTYL PHTHALATE	1.0	1.3	N-D	1.3	.4
	DIETHYL PHTHALATE	2.7	N-D	N-D	N-D	N-D
	1,2-BENZANTHRACENE	N-D	.6	N-D	.6	L 0.1
	CHRYSENE	N-D	.6	N-D	.6	L 0.1
	ANTHRACENE	N-D	3.4	N-D	3.4	.7
	PHENANTHRENE	N-D	3.4	N-D	3.4	.7
	PYRENE	N-D	.7	N-D	.7	L 0.1
PESTICIDES	HEPTACHLOR	.2	N-D	N-D	N-D	N-D
	HEPTACHLOR EPOXIDE	L 0.1	L 0.1	L 0.1	N-D	N-D

HEAT TREATED SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 7

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	HEAT TREATED SLUDGE
PESTICIDES	GAMMA-BHC	.2	.2	.2	N-D	N-D
	DELTA-BHC	L 0.1	N-D	N-D	N-D	N-D
METALS	ANTIMONY	2.6	6.9	1.1	5.8	1.7
	ARSENIC	N-D	1.4	N-D	1.4	.3
	BERYLLIUM	L 0.1	1.0	1.0	N-D	N-D
	CADMIUM	2.0	4.1	2.1	2.0	.5
	CHROMIUM	117	319	20.7	298	93.3
	COPPER	90.1	204	15.5	188	58.9
	CYANIDE	16.8	20.0	9.7	10.3	.5
	LEAD	28.9	200	18.7	181	10.2
	MERCURY	.4	1.2	.4	.8	.2
	NICKEL	139	242	130	112	34.4
	SELENIUM	N-D	.6	N-D	.6	.2
	SILVER	2.1	1.0	.3	.7	.3
	ZINC	250	570	43.3	527	165
NON-CONV. METALS	ALUMINUM	188	-	34.9	NOT RUN	NOT RUN
	BARIUM	33.9	-	9.2	NOT RUN	NOT RUN
	BORON	307	-	316	NOT RUN	NOT RUN
	CALCIUM	29891	-	28775	NOT RUN	NOT RUN
	COBALT	4.3	-	4.1	NOT RUN	NOT RUN
	IRON	1402	-	164	NOT RUN	NOT RUN
	MAGNESIUM	8029	-	7629	NOT RUN	NOT RUN
	MANGANESE	24.9	-	24.1	NOT RUN	NOT RUN
	MOLYBDENUM	6.7	-	6.0	NOT RUN	NOT RUN
	SODIUM	52966	-	52129	NOT RUN	NOT RUN
	TIN	9.2	-	5.3	NOT RUN	NOT RUN
	TITANIUM	2.7	-	1.4	NOT RUN	NOT RUN
	VANADIUM	57.5	-	53.0	NOT RUN	NOT RUN
	YTTRIUM	1.3	-	1.1	NOT RUN	NOT RUN

HEAT TREATED SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY
THROUGH HEAT TREATMENT SYSTEM

PLANT 7

FRACTION	PARAMETER	COMBINED SLUDGE	TOTAL OUT	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
CONVENTIONALS	BOD	112870	63342	48336	15006
	TOTAL SUSP. SOLIDS	143967	46929	43838	3091
	COD	213879	118109	96499	21610
	OIL & GREASE	32785	16580	16007	573
NON-CONVENTIONALS	TOTAL PHENOLS	4.7	10.3	5.9	4.4
	TOTAL SOLIDS	169391	73182	58014	15168
	TOTAL DISS. SOLIDS	17501	28035	15958	12077
	TOTAL VOLATILE SOLIDS	114718	50891	38537	12354
	VOLATILE DISS. SOLIDS	9209	23248	12630	10618
	TOTAL VOL. SUS. SOLIDS	90772	27087	25351	1736
	AMMONIA NITROGEN	1055	1324	859	465
	TOC	37166	23470	14050	9420
VOLATILES	BENZENE	.4	.8	.8	L 0.1
	CHLOROBENZENE	L 0.1	L 0.1	L 0.1	L 0.1
	1,1-DICHLOROETHANE	1.4	N-D	N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	.1	N-D	N-D	N-D
	CHLOROFORM	L 0.1	N-D	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	6.2	.5	.5	L 0.1
	1,2-DICHLOROPROPANE	N-D	L 0.1	L 0.1	N-D
	1,3-DICHLOROPROPYLENE	N-D	L 0.1	L 0.1	N-D
	ETHYLBENZENE	8.6	.8	.8	L 0.1
	METHYLENE CHLORIDE	L 0.1	L 0.1	L 0.1	L 0.1
	DICHLORODIFLUOROMETHANE	.1	N-D	N-D	N-D
	TETRACHLOROETHYLENE	L 0.1	L 0.1	L 0.1	N-D
	TOLUENE	19.0	4.0	3.9	L 0.1
	TRICHLOROETHYLENE	L 0.1	L 0.1	L 0.1	N-D
ACID EXTRACT	PENTACHLOROPHENOL	4.1	N-D	N-D	N-D
	PHENOL	.7	3.9	2.9	1.0
BASE-NEUTRALS	1,2-DICHLOROBENZENE	1.0	.1	L 0.1	L 0.1
	1,3-DICHLOROBENZENE	.1	N-D	N-D	N-D
	1,4-DICHLOROBENZENE	.1	L 0.1	L 0.1	N-D
	FLUORANTHENE	.6	L 0.1	L 0.1	N-D
	NAPHTHALENE	.7	L 0.1	L 0.1	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	46.2	18.5	16.9	1.6
	BUTYL BENZYL PHTHALATE	4.8	1.2	1.2	N-D
	DI-N-BUTYL PHTHALATE	1.3	.4	.4	N-D
	1,2-BENZANTHRACENE	.6	L 0.1	L 0.1	N-D
	CHRYSENE	.6	L 0.1	L 0.1	N-D
	ANTHRACENE	3.4	.7	.7	N-D
	PHENANTHRENE	3.4	.7	.7	N-D
	PYRENE	.7	L 0.1	L 0.1	N-D
PESTICIDES	HEPTACHLOR	N-D	L 0.1	N-D	L 0.1
	HEPTACHLOR EPOXIDE	N-D	L 0.1	N-D	L 0.1
	GAMMA-BHC	N-D	L 0.1	N-D	L 0.1

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY
THROUGH HEAT TREATMENT SYSTEM

PLANT 7

FRACTION	PARAMETER	COMBINED SLUDGE	TOTAL OUT	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
METALS	ANTIMONY	5.8	1.8	1.7	L 0.1
	ARSENIC	1.4	.4	.3	L 0.1
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1
	CADMIUM	2.0	.6	.5	.1
	CHROMIUM	298	103	93.3	10.3
	COPPER	188	65.0	58.9	6.1
	CYANIDE	10.3	.6	.5	L 0.1
	LEAD	181	12.0	10.2	1.8
	MERCURY	.8	.2	.2	L 0.1
	NICKEL	112	45.0	34.4	10.6
	SELENIUM	.6	.2	.2	L 0.1
	SILVER	.7	.3	.3	L 0.1
	THALLIUM	N-D	L 0.1	N-D	L 0.1
	ZINC	527	200	165	35.0
NON-CONV. METALS	ALUMINUM	NOT RUN	-	NOT-RUN	16.7
	BARIUM	NOT RUN	-	NOT-RUN	1.0
	BORON	NOT RUN	-	NOT-RUN	1.1
	CALCIUM	NOT RUN	-	NOT-RUN	331
	COBALT	NOT RUN	-	NOT-RUN	.2
	IRON	NOT RUN	-	NOT-RUN	49.5
	MAGNESIUM	NOT RUN	-	NOT-RUN	75.2
	MANGANESE	NOT RUN	-	NOT-RUN	1.2
	MOLYBDENUM	NOT RUN	-	NOT-RUN	.2
	SODIUM	NOT RUN	-	NOT-RUN	176
	TIN	NOT RUN	-	NOT-RUN	.4
	TITANIUM	NOT RUN	-	NOT-RUN	.2
	VANADIUM	NOT RUN	-	NOT-RUN	.7
	YTTRIUM	NOT RUN	-	NOT-RUN	L 0.1

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 7

PARAMETER	INFL-UENT		SECONDARY EFFL		COMB. SLDG		HEAT TREATED SLUDGE		DECANT	
1,1,1-TRICHLOROETHANE	100	(6)	100	(6)	0	(6)	0	(6)	0	(6)
ETHYLBENZENE	100	(6)	0	(6)	83	(6)	83	(6)	100	(6)
METHYLENE CHLORIDE	100	(6)	100	(6)	100	(6)	50	(6)	33	(6)
TETRACHLOROETHYLENE	100	(6)	83	(6)	17	(6)	67	(6)	0	(6)
TOLUENE	100	(6)	33	(6)	100	(4)	100	(6)	100	(6)
NAPHTHALENE	100	(6)	0	(6)	33	(6)	17	(6)	17	(6)
BIS(2-ETHYLHEXYL) PHTHALATE	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)
GAMMA-BHC	100	(6)	100	(6)	0	(6)	0	(6)	33	(6)
CHROMIUM	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)
COPPER	100	(6)	83	(6)	100	(6)	100	(6)	100	(6)
CYANIDE	100	(6)	83	(6)	100	(6)	100	(6)	100	(6)
MERCURY	100	(6)	100	(6)	100	(6)	100	(6)	83	(6)
ZINC	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)
CHLOROFORM	83	(6)	50	(6)	17	(6)	0	(6)	0	(6)
1,2-TRANS-DICHLOROETHYLENE	83	(6)	67	(6)	100	(6)	100	(6)	100	(6)
TRICHLOROETHYLENE	83	(6)	100	(6)	33	(6)	50	(6)	0	(6)
PHENOL	83	(6)	0	(6)	50	(6)	83	(6)	100	(6)
HEPTACHLOR	83	(6)	0	(6)	0	(6)	0	(6)	67	(6)
CADMIUM	83	(6)	83	(6)	100	(6)	100	(6)	100	(6)
NICKEL	83	(6)	83	(6)	100	(6)	100	(6)	100	(6)
SILVER	83	(6)	33	(6)	100	(6)	100	(6)	100	(6)
LEAD	67	(6)	67	(6)	100	(6)	100	(6)	100	(6)
BENZENE	50	(6)	0	(6)	100	(6)	100	(6)	100	(6)
1,2-DICHLOROBENZENE	50	(6)	0	(6)	33	(6)	17	(6)	33	(6)
DIETHYL PHTHALATE	50	(6)	0	(6)	0	(6)	0	(6)	0	(6)
1,1-DICHLOROETHANE	33	(6)	0	(6)	100	(6)	0	(6)	0	(6)
DI-N-BUTYL PHTHALATE	33	(6)	0	(6)	100	(6)	83	(6)	0	(6)
ANTIMONY	33	(6)	33	(6)	100	(6)	100	(6)	100	(6)
BUTYL BENZYL PHTHALATE	17	(6)	0	(6)	100	(6)	83	(6)	0	(6)
HEPTACHLOR EPOXIDE	17	(6)	17	(6)	0	(6)	0	(6)	17	(6)
DELTA-BHC	17	(6)	0	(6)	0	(6)	0	(6)	0	(6)
BERYLLIUM	17	(6)	33	(6)	0	(6)	0	(6)	67	(6)
CHLOROBENZENE	0	(6)	0	(6)	17	(6)	17	(6)	17	(6)
1,1,2,2-TETRACHLOROETHANE	0	(6)	0	(6)	50	(6)	0	(5)	0	(6)
1,2-DICHLOROPROPANE	0	(6)	0	(6)	0	(5)	80	(5)	0	(6)
1,3-DICHLOROPROPYLENE	0	(6)	0	(6)	0	(6)	17	(6)	0	(6)
DICHLORODIFLUOROMETHANE	0	(6)	0	(6)	17	(6)	0	(6)	0	(6)
PENTACHLOROPHENOL	0	(6)	0	(6)	17	(6)	0	(6)	0	(6)
1,3-DICHLOROBENZENE	0	(6)	0	(6)	17	(6)	0	(6)	0	(6)
1,4-DICHLOROBENZENE	0	(6)	0	(6)	17	(6)	17	(6)	0	(6)
FLUORANTHENE	0	(6)	0	(6)	83	(6)	17	(6)	0	(6)
1,2-BENZANTHRACENE	0	(6)	0	(6)	83	(6)	17	(6)	0	(6)
CHRYSENE	0	(6)	0	(6)	83	(6)	17	(6)	0	(6)
ANTHRACENE	0	(6)	0	(6)	100	(6)	100	(6)	0	(6)
PHENANTHRENE	0	(6)	0	(6)	100	(6)	100	(6)	0	(6)
PYRENE	0	(6)	0	(6)	83	(6)	17	(6)	0	(6)
ARSENIC	0	(6)	0	(6)	100	(6)	100	(6)	100	(6)
SELENIUM	0	(6)	0	(6)	100	(6)	100	(6)	100	(6)
THALLIUM	0	(6)	0	(6)	0	(6)	0	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT E

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
CONV.	BOD	MG/L	236	42	82	32667	27200	55833	9378
	TOTAL SUSP. SOLIDS	MG/L	205	69	66	107733	76755	189100	273
	COD	MG/L	544	211	61	178667	118333	293667	16333
	OIL & GREASE	MG/L	115	14	88	50467	24550	62375	36
NON-CONV.	TOTAL PHENOLS	UG/L	72	13	82	1817	2413	7150	3200
	TOTAL SOLIDS	MG/L	926	746	20	116174	94439	194996	10590
	TOTAL DISS. SOLIDS	MG/L	723	677	6	6487	3305	7553	10317
	SETTLEABLE SOLIDS	ML/L	4	2	50	820	310	940	1
	TOTAL VOLATILE SOLIDS	MG/L	453	321	29	71742	53549	109432	8942
	VOLATILE DISS. SOLIDS	MG/L	309	268	13	3961	2343	5733	8774
	TOTAL VOL. SUS. SOLIDS	MG/L	144	53	63	66583	48145	102933	172
	AMMONIA NITROGEN	MG/L	16	20		200	653	709	900
	TOC	MG/L	119	52	56	14333	13033	17333	6767
VOLATILES	ACRYLONITRILE	UG/L	L 19	L 19		33	25	165	L 19
	BENZENE	UG/L	2	7		11	16	773	22
	CHLOROBENZENE	UG/L	L 1	L 1		15	L 5	33	1
	1,1,1-TRICHLOROETHANE	UG/L	33	L 2	94	73	L 5	13	L 2
	1,1-DICHLOROETHANE	UG/L	1	L 1		193	1	L 5	L 1
	1,1,2-TRICHLOROETHANE	UG/L	L 2	L 2		L 5	3	L 5	L 2
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		1	L 5	13	L 1
	CHLOROETHANE	UG/L	L 15	L 15		L 5	2000	L 5	L 15
	CHLOROFORM	UG/L	6	11		3	L 5	L 5	L 1
	1,1-DICHLOROETHYLENE	UG/L	L 1	L 1		17	L 5	5	L 1
	1,2-TRANS-DICHLOROETHYLENE	UG/L	L 2	L 2		1333	1259	805	L 2
	1,2-DICHLOROPROPANE	UG/L	1	L 1		7	2	3	L 1
	ETHYLBENZENE	UG/L	15	2	87	770	359	1266	7
	METHYLENE CHLORIDE	UG/L	14	7	50	L 5	L 5	L 5	19
	METHYL CHLORIDE	UG/L	L 34	L 34		L 5	L 5	125	L 34
	METHYL BROMIDE	UG/L	L 6	L 6		11	L 5	5	L 6
	DICHLORODIFLUOROMETHANE	UG/L	L 30	L 30		1533	474	1693	L 30
	TETRACHLOROETHYLENE	UG/L	26	1	96	10	3	240	L 2
	TOLUENE	UG/L	229	288		7710	7635	41575	1625
	TRICHLOROETHYLENE	UG/L	30	0	100	19	5	165	2
	VINYL CHLORIDE	UG/L	L 33	L 33		L 5	250	L 5	L 33
ACIDS.	2,4-DICHLOROPHENOL	UG/L	0	0		N-D	N-D	N-D	2
	PENTACHLOROPHENOL	UG/L	18	17	6	2267	823	1300	60
	PHENOL	UG/L	9	1	89	847	610	1238	334

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN;   N-D NOT DETECTED;

PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT E

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
BASE-NEUT.	ACENAPHTHENE	UG/L	L 10	L 10		N-D	1150	N-D	L 10
	HEXACHLOROBENZENE	UG/L	L 9	L 9		N-D	195	N-D	L 9
	2-CHLORONAPHTHALENE	UG/L	L 3	L 3		N-D	400	N-D	L 3
	1,2-DICHLOROBENZENE	UG/L	L 2	L 2		N-D	250	N-D	L 2
	1,3-DICHLOROBENZENE	UG/L	L 2	L 2		N-D	475	N-D	L 2
	1,4-DICHLOROBENZENE	UG/L	1	L 2		N-D	325	N-D	L 2
	FLUORANTHENE	UG/L	1	L 3		557	600	577	L 3
	HEXACHLOROBUTADIENE	UG/L	L 6	L 6		N-D	575	N-D	L 5
	NAPHTHALENE	UG/L	12	L 2	83	1833	1159	686	2
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	33	7	79	17000	10500	20200	6
	BUTYL BENZYL PHTHALATE	UG/L	50	4	92	34667	17775	33425	L 3
	DI-N-BUTYL PHTHALATE	UG/L	2	4		1067	1045	1686	L 3
	DIETHYL PHTHALATE	UG/L	2	L 4		N-D	N-D	N-D	L 4
	DIMETHYL PHTHALATE	UG/L	L 6	L 6		217	150	N-D	L 6
	1,2-BENZANTHRACENE	UG/L	L 3	L 3		433	750	119	L 3
	BENZO (A)PYRENE	UG/L	L 25	L 25		N-D	N-D	11	L 25
	CHRYSENE	UG/L	L 3	L 3		433	750	119	L 3
	ANTHRACENE	UG/L	2	L 3		550	1565	690	L 3
	PHENANTHRENE	UG/L	2	L 3		550	1565	690	L 3
	PYRENE	UG/L	L 3	L 3		563	734	766	L 3
METALS	ANTIMONY	UG/L	L 50	L 50		1277	1315	1825	L 500
	ARSENIC	UG/L	L 50	L 50		1033	695	1463	L 500
	BERYLLIUM	UG/L	L 2	L 3		33	22	44	L 2
	CADMIUM	UG/L	L 2	L 2		470	450	780	L 2
	CHROMIUM	UG/L	250	85	67	118667	101250	150000	1155
	COPPER	UG/L	337	108	68	140667	120500	202500	212
	CYANIDE	UG/L	11	4	64	2787	3340	1526	44
	LEAD	UG/L	329	85	74	65667	93750	95250	192
	MERCURY	NG/L	350	L 200	43	250000	172500	505000	225
	NICKEL	UG/L	427	236	45	71000	60000	92000	6945
	SELENIUM	UG/L	L 50	20		233	170	328	L 500
	SILVER	UG/L	13	1	92	117	150	100	L 2
	ZINC	UG/L	1722	500	71	513333	715000	1335000	7495
N-C METALS	ALUMINUM	UG/L	1278	474	63	N-D	N-D	N-D	1323
	BARIUM	UG/L	539	185	66	N-D	N-D	N-D	373
	CALCIUM	MG/L	54	59		N-D	N-D	N-D	140
	IRON	UG/L	5400	1814	67	N-D	N-D	N-D	19300
	MAGNESIUM	MG/L	15	15		N-D	N-D	N-D	33

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT E

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	COMBINED SLUDGE	HEAT TREATED SLUDGE	HEAT TREATMENT DECANT
N-C METALS	MANGANESE	UG/L	190	152	20	N-D	N-D	N-D	243
	SODIUM	MG/L	140	139	1	N-D	N-D	N-D	97

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 8

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	PRIMARY SLUDGE
CONVENTIONALS	BOD	45008	48649	7865	40784	24490
	TOTAL SUSP. SOLIDS	38802	128209	13123	115086	80768
	COD	103092	217415	39986	177429	133946
	OIL & GREASE	21841	39368	2558	36810	37835
NON-CONVENTIONALS	TOTAL PHENOLS	13.6	6.0	2.4	3.6	1.4
	TOTAL SOLIDS	175863	267981	141373	126608	87095
	TOTAL DISS. SOLIDS	137061	133206	128249	4957	4863
	TOTAL VOLATILE SOLIDS	85752	141028	60737	80291	53785
	VOLATILE DISS. SOLIDS	58463	54300	50788	3512	2969
	TOTAL VOL. SUS. SOLIDS	27289	82138	9949	72189	49918
	AMMONIA NITROGEN	2937	4818	3838	980	150
	TOC	22551	30502	9760	20742	10746
VOLATILES	ACRYLONITRILE	N-D	L 0.1	N-D	L 0.1	L 0.1
	BENZENE	.3	1.4	1.4	L 0.1	L 0.1
	CHLOROBENZENE	N-D	N-D	N-D	N-D	L 0.1
	1,1,1-TRICHLOROETHANE	6.2	N-D	N-D	N-D	L 0.1
	1,1-DICHLOROETHANE	.2	L 0.1	N-D	L 0.1	.1
	1,1,2-TRICHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,2,2-TETRACHLOROETHANE	N-D	N-D	N-D	N-D	L 0.1
	CHLOROETHANE	N-D	3.0	N-D	3.0	N-D
	CHLOROFORM	1.5	2.1	2.1	N-D	L 0.1
	1,1-DICHLOROETHYLENE	N-D	N-D	N-D	N-D	L 0.1
	1,2-TRANS-DICHLOROETHYLENE	N-D	1.9	N-D	1.9	1.0
	1,2-DICHLOROPROPANE	.2	L 0.1	N-D	L 0.1	L 0.1
	ETHYLBENZENE	2.8	.8	.3	.5	.6
	METHYLENE CHLORIDE	2.6	1.3	1.3	N-D	N-D
	METHYL BROMIDE	N-D	N-D	N-D	N-D	L 0.1
	DICHLORODIFLUOROMETHANE	N-D	.7	N-D	.7	1.1
	TETRACHLOROETHYLENE	4.9	L 0.1	L 0.1	L 0.1	L 0.1
	TOLUENE	43.3	66.0	54.6	11.4	5.8
	TRICHLOROETHYLENE	5.6	L 0.1	L 0.1	L 0.1	L 0.1
	VINYL CHLORIDE	N-D	.4	N-D	.4	N-D
ACID EXTRACT	2,4-DICHLOROPHENOL	L 0.1	L 0.1	L 0.1	N-D	N-D
	PENTACHLOROPHENOL	3.5	4.4	3.2	1.2	1.7
	PHENOL	1.6	1.0	L 0.1	.9	.6
BASE-NEUTRALS	ACENAPHTHENE	N-D	1.7	N-D	1.7	N-D
	HEXACHLOROBENZENE	N-D	.3	N-D	.3	N-D
	2-CHLORONAPHTHALENE	N-D	.6	N-D	.6	N-D
	1,2-DICHLOROBENZENE	N-D	.4	N-D	.4	N-D
	1,3-DICHLOROBENZENE	N-D	.7	N-D	.7	N-D
	1,4-DICHLOROBENZENE	L 0.1	.5	N-D	.5	N-D
	FLUORANTHENE	.2	.9	N-D	.9	.4
	HEXACHLOROBUTADIENE	N-D	1.0	N-D	1.0	N-D
	NAPHTHALENE	2.3	1.7	N-D	1.7	1.4
	BIS(2-ETHYLHEXYL) PHTHALATE	6.3	17.0	1.3	15.7	12.7
	BUTYL BENZYL PHTHALATE	9.5	27.5	.8	26.7	26.0
	DI-N-BUTYL PHTHALATE	.3	2.3	.7	1.6	.8

PRIMARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 8

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	PRIMARY SLUDGE
BASE-NEUTRALS	DIETHYL PHTHALATE	.4	N-D	N-D	N-D	N-D
	DIMETHYL PHTHALATE	N-D	.2	N-D	.2	.2
	1,2-BENZANTHRACENE	N-D	1.1	N-D	1.1	.3
	CHRYSENE	N-D	1.1	N-D	1.1	.3
	ANTHRACENE	.3	2.3	N-D	2.3	.4
	PHENANTHRENE	.3	2.3	N-D	2.3	.4
	PYRENE	N-D	1.1	N-D	1.1	.7
METALS	ANTIMONY	N-D	1.5	N-D	1.5	1.0
	ARSENIC	N-D	1.0	N-D	1.0	.8
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	N-D	.7	N-D	.7	.4
	CHROMIUM	48.5	168	16.0	152	89.0
	COPPER	63.8	202	20.5	181	105
	CYANIDE	2.1	5.4	.8	4.6	2.1
	LEAD	62.4	164	16.0	148	49.2
	MERCURY	L 0.1	.3	N-D	.3	.2
	NICKEL	80.9	135	44.6	90.0	53.2
	SELENIUM	N-D	5.2	4.9	.3	.2
	SILVER	2.5	.4	.2	.2	.1
	ZINC	326	1167	94.7	1072	685
NON-CONV. METALS	ALUMINUM	242	89.9	89.9	N-D	N-D
	BARIUM	102	35.1	35.1	N-D	N-D
	CALCIUM	10186	11134	11134	N-D	N-D
	IRON	1035	344	344	N-D	N-D
	MAGNESIUM	2748	2748	2748	N-D	N-D
	MANGANESE	35.9	28.8	28.8	N-D	N-D
	SODIUM	26484	26294	26294	N-D	N-D

PRIMARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT B

PARAMETER	INFL-UENT		SEC. EFFL		PRIM. SLDG.		COMB. SLDG		HEAT TREATED SLUDGE		DECANT	
1,1,1-TRICHLOROETHANE	100	(4)	0	(4)	67	(3)	0	(4)	25	(4)	0	(4)
1,1-DICHLOROETHANE	100	(4)	0	(4)	100	(3)	25	(4)	0	(4)	0	(4)
CHLOROFORM	100	(4)	100	(4)	33	(3)	0	(4)	0	(4)	0	(4)
1,2-DICHLOROPROPANE	100	(4)	0	(4)	67	(3)	100	(4)	25	(4)	0	(4)
ETHYLBENZENE	100	(4)	50	(4)	100	(3)	100	(4)	100	(4)	100	(4)
METHYLENE CHLORIDE	100	(4)	100	(4)	0	(3)	0	(4)	0	(4)	100	(4)
TETRACHLOROETHYLENE	100	(4)	25	(4)	100	(3)	50	(4)	100	(4)	0	(4)
TOLUENE	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
TRICHLOROETHYLENE	100	(4)	25	(4)	67	(3)	75	(4)	100	(4)	75	(4)
PHENOL	100	(4)	50	(4)	67	(3)	75	(4)	50	(4)	100	(4)
NAPHTHALENE	100	(4)	0	(4)	100	(3)	100	(4)	75	(4)	25	(4)
BUTYL BENZYL PHTHALATE	100	(4)	75	(4)	100	(3)	100	(4)	100	(4)	0	(4)
CHROMIUM	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
COPPER	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
CYANIDE	100	(4)	50	(4)	100	(3)	100	(4)	100	(4)	100	(4)
LEAD	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
MERCURY	100	(4)	0	(4)	100	(3)	100	(4)	100	(4)	50	(4)
NICKEL	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
SILVER	100	(4)	25	(4)	100	(3)	100	(4)	100	(4)	0	(4)
ZINC	100	(4)	100	(4)	100	(3)	100	(4)	100	(4)	100	(4)
BENZENE	75	(4)	25	(4)	67	(3)	100	(4)	100	(4)	100	(4)
PENTACHLOROPHENOL	75	(4)	100	(4)	67	(3)	75	(4)	50	(4)	100	(4)
BIS(2-ETHYLHEXYL) PHTHALATE	75	(4)	100	(4)	100	(3)	75	(4)	100	(4)	25	(4)
DI-N-BUTYL PHTHALATE	50	(4)	75	(4)	67	(3)	100	(4)	100	(4)	0	(4)
DIETHYL PHTHALATE	50	(4)	0	(4)	0	(3)	0	(4)	0	(4)	0	(4)
2,4-DICHLOROPHENOL	25	(4)	25	(4)	0	(3)	0	(4)	0	(4)	50	(4)
1,4-DICHLOROBENZENE	25	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
FLUORANTHENE	25	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
ANTHRACENE	25	(4)	0	(4)	67	(3)	75	(4)	75	(4)	0	(4)
PHENANTHRENE	25	(4)	0	(4)	67	(3)	75	(4)	75	(4)	0	(4)
ACRYLONITRILE	0	(4)	0	(4)	33	(3)	25	(4)	75	(4)	0	(4)
CHLOROBENZENE	0	(4)	0	(4)	100	(3)	0	(4)	100	(4)	50	(4)
1,1,2-TRICHLOROETHANE	0	(4)	0	(4)	0	(3)	50	(4)	0	(4)	0	(4)
1,1,2,2-TETRACHLOROETHANE	0	(4)	0	(4)	33	(3)	0	(4)	75	(4)	0	(4)
CHLOROETHANE	0	(4)	0	(4)	0	(3)	75	(4)	0	(4)	0	(4)
1,1-DICHLOROETHYLENE	0	(4)	0	(4)	67	(3)	0	(4)	25	(4)	0	(4)
1,2-TRANS-DICHLOROETHYLENE	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
METHYL CHLORIDE	0	(4)	0	(4)	0	(3)	0	(4)	25	(4)	0	(4)
METHYL BROMIDE	0	(4)	0	(4)	33	(3)	0	(4)	25	(4)	0	(4)
DICHLORODIFLUOROMETHANE	0	(4)	0	(4)	67	(3)	50	(4)	100	(4)	0	(4)
VINYL CHLORIDE	0	(4)	0	(4)	0	(3)	50	(4)	0	(4)	0	(4)
ACENAPHTHENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
HEXACHLOROBENZENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
2-CHLORONAPHTHALENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
1,2-DICHLOROBENZENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
1,3-DICHLOROBENZENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
HEXACHLOROBUTADIENE	0	(4)	0	(4)	0	(3)	25	(4)	0	(4)	0	(4)
DIMETHYL PHTHALATE	0	(4)	0	(4)	33	(3)	25	(4)	0	(4)	0	(4)
1,2-BENZANTHRACENE	0	(4)	0	(4)	33	(3)	50	(4)	50	(4)	0	(4)
BENZO (A)PYRENE	0	(4)	0	(4)	0	(3)	0	(4)	50	(4)	0	(4)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT B

PARAMETER	INFL-UENT		SEC. EFFL		PRIM. SLDG.		COMB. SLDG		HEAT TREATED SLUDGE		DECANT	
CHRYSENE	0	(4)	0	(4)	33	(3)	50	(4)	50	(4)	0	(4)
PYRENE	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
ANTIMONY	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
ARSENIC	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
BERYLLIUM	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
CADMIUM	0	(4)	0	(4)	100	(3)	100	(4)	100	(4)	0	(4)
SELENIUM	0	(4)	25	(4)	100	(3)	100	(4)	100	(4)	0	(4)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 9

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	113	5	96	10866	1846
	TOTAL SUSP. SOLIDS	MG/L	149	14	91	39536	6281
	COD	MG/L	267	36	87	49365	6762
	OIL & GREASE	MG/L	36	6	83	1563	165
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	67	7	90	657	379
	TOTAL SOLIDS	MG/L	455	292	36	40697	6713
	TOTAL DISS. SOLIDS	MG/L	234	235		1162	434
	SETTLEABLE SOLIDS	ML/L	9	L 1	89	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	MG/L	190	66	65	30668	4690
	VOLATILE DISS. SOLIDS	MG/L	54	50	7	394	34
	TOTAL VOL. SUS. SOLIDS	MG/L	131	9	93	30274	4657
	AMMONIA NITROGEN	MG/L	10	3	70	103	31
	TOC	MG/L	86	12	86	10487	1610
VOLATILES	BENZENE	UG/L	1	4		6	L 5
	CARBON TETRACHLORIDE	UG/L	1	L 5		N-D	N-D
	CHLOROBENZENE	UG/L	L 5	1		8	L 5
	1,1,1-TRICHLOROETHANE	UG/L	L 5	L 5		6	L 5
	1,1-DICHLOROETHANE	UG/L	L 5	L 5		195	L 5
	1,1,2-TRICHLOROETHANE	UG/L	25	1	96	N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	1	L 5		1	L 5
	CHLOROETHANE	UG/L	L 5	L 5		16450	685
	CHLOROFORM	UG/L	4	2	50	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	L 5	L 5		408	20
	1,2-DICHLOROPROPANE	UG/L	L 5	L 5		6	L 5
	ETHYLBENZENE	UG/L	1	1		51	2
	METHYLENE CHLORIDE	UG/L	5	L 5		7	L 5
	METHYL CHLORIDE	UG/L	2	2		1267	L 5
	METHYL BROMIDE	UG/L	L 5	L 5		11270	503
	TETRACHLOROETHYLENE	UG/L	4	0	100	45	L 5
	TOLUENE	UG/L	8	0	100	1694	1167
	TRICHLOROETHYLENE	UG/L	33	L 5	85	193	2
	VINYL CHLORIDE	UG/L	L 5	L 5		5847	12
ACID EXTRACT	PARACHLOROMETA CRESOL	UG/L	2	L 50		N-D	N-D
	4,6-DINITRO-O-CRESOL	UG/L	L 50	0		N-D	N-D
	PHENOL	UG/L	2	L 60		33	478
BASE-NEUTRALS	HEXACHLOROBENZENE	UG/L	L 20	L 20		N-D	5
	FLUORANTHENE	UG/L	L 10	L 10		65	9

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 9

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	5	L 20		2817	460
	BUTYL BENZYL PHTHALATE	UG/L	L 20	L 20		767	47
	DI-N-BUTYL PHTHALATE	UG/L	13	16		110	12
	DIETHYL PHTHALATE	UG/L	11	2	82	7	8
	DIMETHYL PHTHALATE	UG/L	L 20	L 20		17	5
	1,2-BENZANTHRACENE	UG/L	L 10	L 10		11	8
	BENZO (A)PYRENE	UG/L	L 10	L 10		50	N-D
	11,12-BENZOFLUORANTHENE	UG/L	L 10	L 10		10	N-D
	CHRYSENE	UG/L	L 10	L 10		N-D	8
	ANTHRACENE	UG/L	L 20	L 20		92	16
	PHENANTHRENE	UG/L	L 20	L 20		92	16
	PYRENE	UG/L	L 10	L 10		72	12
METALS	ANTIMONY	UG/L	0	0		40	14
	ARSENIC	UG/L	2	2		37	19
	BERYLLIUM	UG/L	L 1	L 1		1	L 6
	CADMIUM	UG/L	3	2	33	257	152
	CHROMIUM	UG/L	55	3	95	7333	2197
	COPPER	UG/L	70	26	63	11833	3900
	CYANIDE	UG/L	82	27	67	30523	440
	LEAD	UG/L	91	17	81	6200	2250
	MERCURY	NG/L	L 1000	L 1000		114667	46333
	NICKEL	UG/L	38	25	34	4767	858
	SELENIUM	UG/L	2	2		47	40
	SILVER	UG/L	11	1	91	128	328
	ZINC	UG/L	160	57	64	25983	4800
NON-CONV. METALS	ALUMINUM	UG/L	577	98	83	NOT RUN	NOT RUN
	BARIUM	UG/L	115	34	70	NOT RUN	NOT RUN
	BORON	UG/L	145	131	10	NOT RUN	NOT RUN
	CALCIUM	MG/L	29	27	7	NOT RUN	NOT RUN
	IRON	UG/L	1505	372	75	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	7	7		NOT RUN	NOT RUN
	MANGANESE	UG/L	169	91	46	NOT RUN	NOT RUN
	MOLYBDENUM	UG/L	L 36	7		NOT RUN	NOT RUN
	SODIUM	MG/L	46	46		NOT RUN	NOT RUN
	TIN	UG/L	20	L 26		NOT RUN	NOT RUN
	TITANIUM	UG/L	27	6	78	NOT RUN	NOT RUN
	VANADIUM	UG/L	4	2	50	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 9

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	48759	15458	2014	4526	8918
	TOTAL SUSP. SOLIDS	64221	52996	6185	16467	30344
	COD	114993	68764	15534	20561	32669
	OIL & GREASE	15318	4188	2733	659	796
NON-CONVENTIONALS	TOTAL PHENOLS	28.8	5.1	3.0	.3	1.8
	TOTAL SOLIDS	196258	175377	125996	16950	32431
	TOTAL DISS. SOLIDS	100898	103979	101401	484	2094
	TOTAL VOLATILE SOLIDS	81840	63913	28479	12773	22661
	VOLATILE DISS. SOLIDS	23373	22046	21719	164	163
	TOTAL VOL. SUS. SOLIDS	56382	39133	4027	12609	22497
	AMMONIA NITROGEN	4099	1485	1294	43.0	148
	TOC	37252	17181	5034	4368	7779
VOLATILES	BENZENE	.3	1.9	1.9	L 0.1	N-D
	CARBON TETRACHLORIDE	.4	N-D	N-D	N-D	N-D
	CHLOROBENZENE	N-D	.2	.2	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1-DICHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,2-TRICHLOROETHANE	9.8	.4	.4	N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	.4	L 0.1	N-D	L 0.1	N-D
	CHLOROETHANE	N-D	10.2	N-D	6.9	3.3
	CHLOROFORM	1.7	.7	.7	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	N-D	.3	N-D	.2	L 0.1
	1,2-DICHLOROPROPANE	N-D	L 0.1	N-D	L 0.1	N-D
	ETHYLBENZENE	.2	.4	.4	L 0.1	L 0.1
	METHYLENE CHLORIDE	2.2	L 0.1	N-D	L 0.1	N-D
	METHYL CHLORIDE	.8	1.5	1.0	.5	N-D
	METHYL BROMIDE	N-D	7.1	N-D	4.7	2.4
	TETRACHLOROETHYLENE	1.7	L 0.1	L 0.1	L 0.1	N-D
	TOLUENE	3.3	6.4	.1	.7	5.6
	TRICHLOROETHYLENE	14.3	L 0.1	N-D	L 0.1	L 0.1
	VINYL CHLORIDE	N-D	2.5	N-D	2.4	L 0.1
ACID EXTRACT	PARACHLOROMETA CRESOL	.8	N-D	N-D	N-D	N-D
	4,6-DINITRO-O-CRESOL	N-D	.1	.1	N-D	N-D
	PHENOL	.9	2.3	N-D	L 0.1	2.3
BASE-NEUTRALS	HEXACHLOROBENZENE	N-D	L 0.1	N-D	N-D	L 0.1
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	1.9	3.4	N-D	1.2	2.2
	BUTYL BENZYL PHTHALATE	N-D	.5	N-D	.3	.2
	DI-N-BUTYL PHTHALATE	5.4	6.9	6.8	L 0.1	L 0.1
	DIETHYL PHTHALATE	4.5	.9	.9	L 0.1	L 0.1
	DIMETHYL PHTHALATE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	BENZO (A)PYRENE	N-D	L 0.1	N-D	L 0.1	N-D
	11,12-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	CHRYSENE	N-D	L 0.1	N-D	N-D	L 0.1
	ANTHRACENE	N-D	.1	N-D	L 0.1	L 0.1
	PHENANTHRENE	N-D	.1	N-D	L 0.1	L 0.1
	PYRENE	N-D	L 0.1	N-D	L 0.1	L 0.1

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 9

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	ANTIMONY	L 0.1	.2	L 0.1	L 0.1	L 0.1
	ARSENIC	.9	1.0	.9	L 0.1	L 0.1
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	N-D
	CADMIUM	1.4	1.7	.9	.1	.7
	CHROMIUM	23.7	15.1	1.4	3.1	10.6
	COPPER	30.1	34.8	11.1	4.9	18.8
	CYANIDE	35.2	26.3	11.5	12.7	2.1
	LEAD	39.2	20.6	7.1	2.6	10.9
	MERCURY	N-D	.2	N-D	L 0.1	.2
	NICKEL	16.3	17.0	10.9	2.0	4.1
	SELENIUM	.6	.8	.6	L 0.1	.2
	SILVER	4.7	1.9	.2	L 0.1	1.6
	ZINC	69.0	58.5	24.5	10.8	23.2
NON-CONV. METALS	ALUMINUM	249	-	42.4	NOT RUN	NOT RUN
	BARIUM	49.5	-	14.6	NOT RUN	NOT RUN
	BORON	62.7	-	56.4	NOT RUN	NOT RUN
	CALCIUM	12298	-	11507	NOT RUN	NOT RUN
	IRON	649	-	161	NOT RUN	NOT RUN
	MAGNESIUM	2949	-	2877	NOT RUN	NOT RUN
	MANGANESE	73.1	-	39.3	NOT RUN	NOT RUN
	MOLYBDENUM	N-D	-	2.9	NOT RUN	NOT RUN
	SODIUM	19993	-	19993	NOT RUN	NOT RUN
	TIN	8.6	-	N-D	NOT RUN	NOT RUN
	TITANIUM	11.6	-	2.4	NOT RUN	NOT RUN
	VANADIUM	1.5	-	.8	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 9

PARAMETER	INFLUENT		SECONDARY EFFLUENT		PRIMARY SLUDGE		SECONDARY SLUDGE	
TOLUENE	100	(6)	33	(6)	100	(6)	100	(6)
TRICHLOROETHYLENE	100	(6)	0	(6)	100	(6)	67	(6)
DIETHYL PHTHALATE	100	(6)	50	(6)	17	(6)	17	(6)
CHROMIUM	100	(6)	33	(6)	83	(6)	83	(6)
COPPER	100	(6)	100	(6)	83	(6)	83	(6)
CYANIDE	100	(6)	100	(6)	100	(6)	100	(6)
LEAD	100	(6)	33	(6)	100	(6)	100	(6)
NICKEL	100	(6)	100	(6)	83	(6)	83	(6)
SILVER	100	(6)	50	(6)	83	(6)	83	(6)
ZINC	100	(6)	100	(6)	83	(6)	83	(6)
CHLOROFORM	83	(6)	83	(6)	0	(6)	0	(6)
ARSENIC	83	(6)	100	(6)	100	(6)	100	(6)
1,1,2-TRICHLOROETHANE	67	(6)	17	(6)	0	(6)	0	(6)
TETRACHLOROETHYLENE	67	(6)	17	(6)	100	(6)	0	(6)
PHENOL	67	(6)	0	(6)	17	(6)	83	(6)
CADMIUM	67	(6)	83	(6)	83	(6)	83	(6)
SELENIUM	67	(6)	50	(6)	100	(6)	100	(6)
BIS(2-ETHYLHEXYL) PHTHALATE	50	(6)	0	(6)	100	(6)	83	(6)
DI-N-BUTYL PHTHALATE	50	(6)	33	(6)	67	(6)	17	(6)
METHYL CHLORIDE	33	(6)	33	(6)	33	(6)	0	(6)
PARACHLOROMETA CRESOL	33	(6)	0	(6)	0	(6)	0	(6)
BENZENE	17	(6)	50	(6)	67	(6)	0	(6)
CARBON TETRACHLORIDE	17	(6)	0	(6)	0	(6)	0	(6)
1,1,2,2-TETRACHLOROETHANE	17	(6)	0	(6)	17	(6)	0	(6)
ETHYLBENZENE	17	(6)	17	(6)	100	(6)	50	(6)
METHYLENE CHLORIDE	17	(6)	0	(6)	33	(6)	0	(6)
ANTIMONY	17	(6)	17	(6)	100	(6)	83	(6)
CHLOROBENZENE	0	(6)	17	(6)	50	(6)	0	(6)
1,1,1-TRICHLOROETHANE	0	(6)	0	(6)	17	(6)	0	(6)
1,1-DICHLOROETHANE	0	(6)	0	(6)	83	(6)	0	(6)
CHLOROETHANE	0	(6)	0	(6)	100	(6)	33	(6)
1,2-TRANS-DICHLOROETHYLENE	0	(6)	0	(6)	67	(6)	83	(6)
1,2-DICHLOROPROPANE	0	(6)	0	(6)	67	(6)	0	(6)
METHYL BROMIDE	0	(6)	0	(6)	100	(6)	50	(6)
VINYL CHLORIDE	0	(6)	0	(6)	100	(6)	17	(6)
4,6-DINITRO-O-CRESOL	0	(6)	17	(6)	0	(6)	0	(6)
HEXACHLOROBENZENE	0	(6)	0	(6)	0	(6)	17	(6)
FLUORANTHENE	0	(6)	0	(6)	50	(6)	17	(6)
BUTYL BENZYL PHTHALATE	0	(6)	0	(6)	83	(6)	33	(6)
DIMETHYL PHTHALATE	0	(6)	0	(6)	17	(6)	17	(6)
1,2-BENZANTHRACENE	0	(6)	0	(6)	17	(6)	17	(6)
BENZO (A)PYRENE	0	(6)	0	(6)	17	(6)	0	(6)
11,12-BENZOFLUORANTHENE	0	(6)	0	(6)	14	(7)	0	(6)
CHRYSENE	0	(6)	0	(6)	0	(5)	17	(6)
ANTHRACENE	0	(6)	0	(6)	50	(6)	33	(6)
PHENANTHRENE	0	(6)	0	(6)	50	(6)	33	(6)
PYRENE	0	(6)	0	(6)	50	(6)	17	(6)
BERYLLIUM	0	(6)	0	(6)	17	(6)	0	(6)
MERCURY	0	(6)	0	(6)	100	(6)	100	(6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 10
WATER SAMPLE POINTS ONLY

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	T. F. EFFLUENT
CONVENTIONALS	BOD	MG/L	242	16	93	NOT RUN	23
	TOTAL SUSP. SOLIDS	MG/L	222	16	93	NOT RUN	14
	OIL & GREASE	MG/L	75	17	77	NOT RUN	17
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	64	16	75	NOT RUN	115
	TOTAL SOLIDS	MG/L	850	544	36	NOT RUN	623
	TOTAL DISS. SOLIDS	MG/L	633	489	23	NOT RUN	593
	TOTAL VOLATILE SOLIDS	MG/L	279	126	54	NOT RUN	129
	AMMONIA NITROGEN	MG/L	24	9	63	NOT RUN	19
	TOC	MG/L	114	33	71	NOT RUN	46
VOLATILES	BENZENE	UG/L	0	L 1		L 1	L 1
	CARBON TETRACHLORIDE	UG/L	0	L 1		L 1	L 1
	1,1,1-TRICHLOROETHANE	UG/L	3	L 1	67	L 1	L 1
	1,1-DICHLOROETHANE	UG/L	1	L 1		L 1	L 1
	CHLOROETHANE	UG/L	1	L 10		L 10	L 10
	CHLOROFORM	UG/L	9	1	89	1	2
	1,2-DICHLOROPROPANE	UG/L	0	L 1		L 1	L 1
	ETHYLBENZENE	UG/L	4	L 6		L 6	L 1
	METHYLENE CHLORIDE	UG/L	81	53	35	34	50
	METHYL CHLORIDE	UG/L	50	4	92	L 10	L 10
	TETRACHLOROETHYLENE	UG/L	5	4	20	3	3
	TOLUENE	UG/L	12	L 1	92	L 1	0
	TRICHLOROETHYLENE	UG/L	56	L 1	98	L 1	L 1
	VINYL CHLORIDE	UG/L	L 10	0		L 10	L 10
ACID EXTRACT	PHENOL	UG/L	9	L 1	89	L 1	0
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	UG/L	1	L 5		L 5	L 5
	1,2-DICHLOROBENZENE	UG/L	3	L 3		L 3	L 3
	1,3-DICHLOROBENZENE	UG/L	1	L 3		L 3	L 3
	1,4-DICHLOROBENZENE	UG/L	3	L 3		L 3	L 3
	NAPHTHALENE	UG/L	3	L 2	33	L 2	L 2
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	86	9	90	18	8
	BUTYL BENZYL PHTHALATE	UG/L	3	L 2	33	L 2	L 2
	DI-N-BUTYL PHTHALATE	UG/L	5	6		7	7
	DIETHYL PHTHALATE	UG/L	3	L 3		1	L 3
	11,12-BENZOFLUORANTHENE	UG/L	0	L 10		L 10	L 10
	1,12-BENZOPERYLENE	UG/L	L 20	L 20		L 20	0

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

Reproduced from best available copy.

SUMMARY OF ANALYTICAL DATA

PLANT 10
WATER SAMPLE POINTS ONLY

FRACTION		UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRE CL EFFLUENT	T. F. EFFLUENT
		NG/L	L 30	L 30		L 30	7
	. -DDD	NG/L	L 60	L 60		L 60	36
	ALPHA-BHC	NG/L	L 10	L 10		7	L 10
	BETA-BHC	NG/L	L 40	L 10		L 10	7
	GAMMA-BHC	NG/L	42	12	71	3	27
METALS	CADMIUM	UG/L	2	1	50	NOT RUN	6
	CHROMIUM	UG/L	16	32		NOT RUN	5
	COPPER	UG/L	72	11	85	NOT RUN	10
	CYANIDE	UG/L	822	163	80	NOT RUN	169
	LEAD	UG/L	34	3	91	NOT RUN	4
	MERCURY	NG/L	633	60	91	NOT RUN	0
	NICKEL	UG/L	4	35		NOT RUN	11
	SILVER	UG/L	8	2	75	NOT RUN	1
	ZINC	UG/L	208	73	65	NOT RUN	56
							43
		UG/L	974	148	85	NOT RUN	13
		[illegible]	[illegible]	19	79	NOT RUN	35
NON-CONV. METALS	ALUMINUM	UG/L	40	35.	91	NOT RUN	79
	MAGNESIUM	MG/L	21	14	33	NOT RUN	16
	MANGANESE	UG/L	98	95	3	NOT RUN	90
	SODIUM	MG/L	109	80	27	NOT RUN	96

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY- TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 10
SLUDGE SAMPLE POINTS ONLY

FRACTION	PARAMETER	UNITS	DIGESTED SLUDGE	COMBINED SLUDGE	PCNT REM.	WASTE ACTIVATED SLUDGE	SECONDARY SLUDGE	T. F. SLUDGE
CONVENTIONALS	BOD	MG/L	6276	5556	11	6333	239	NOT RUN
	TOTAL SUSP. SOLIDS	MG/L	28950	32600		NOT RUN	555	5500
	OIL & GREASE	MG/L	290	295		109	56	271
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	718	473	34	725	41	430
	TOTAL SOLIDS	MG/L	18344	25375		11469	1244	11329
	TOTAL DISS. SOLIDS	MG/L	300	NOT RUN		NOT RUN	843	11606
	TOTAL VOLATILE SOLIDS	MG/L	12071	23178		8019	660	9400
	AMMONIA NITROGEN	MG/L	706	49	93	37	25	23
	TOC	MG/L	7570	16264		3894	286	4974
VOLATILES	ACRYLONITRILE	UG/L	N-D	N-D		3	N-D	N-D
	BENZENE	UG/L	4	11		1	0	1
	CHLOROBENZENE	UG/L	4	1	75	N-D	N-D	N-D
	1,1-DICHLOROETHANE	UG/L	N-D	6		N-D	0	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	N-D	N-D		N-D	0	N-D
	CHLOROETHANE	UG/L	N-D	N-D		N-D	N-D	150
	CHLOROFORM	UG/L	1	N-D		N-D	0	N-D
	1,1-DICHLOROETHYLENE	UG/L	N-D	N-D		N-D	0	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	866	536	38	N-D	N-D	15
	1,2-DICHLOROPROPANE	UG/L	0	1		N-D	N-D	N-D
	ETHYLBENZENE	UG/L	119	45	62	N-D	1	1
	METHYLENE CHLORIDE	UG/L	N-D	37		N-D	1	N-D
	METHYL CHLORIDE	UG/L	2	N-D		16	N-D	N-D
	METHYL BROMIDE	UG/L	N-D	N-D		121	N-D	250
	DICHLOROBROMOMETHANE	UG/L	1	N-D		N-D	N-D	N-D
	DICHLORODIFLUOROMETHANE	UG/L	N-D	N-D		N-D	62	N-D
	TETRACHLOROETHYLENE	UG/L	N-D	1		1	19	N-D
	TOLUENE	UG/L	2524	3042		701	12	2342
	TRICHLOROETHYLENE	UG/L	0	2		1	10	N-D
	VINYL CHLORIDE	UG/L	11	145		N-D	N-D	N-D
ACID EXTRACT	PHENOL	UG/L	1191	123	90	N-D	N-D	1300
BASE-NEUTRALS	ACENAPHTHENE	UG/L	N-D	N-D		N-D	N-D	9
	HEXACHLOROBENZENE	UG/L	N-D	48		N-D	N-D	N-D
	FLUORANTHENE	UG/L	18	N-D		N-D	N-D	13
	NAPHTHALENE	UG/L	51	N-D		N-D	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	3722	3900		1260	344	1060

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 1G
SLUDGE SAMPLE POINTS ONLY

FRACTION	PARAMETER	UNITS	DIGESTED SLUDGE	COMBINED SLUDGE	PCNT REM.	WASTE ACTIVATED SLUDGE		SECONDARY SLUDGE	T. F. SLUDGE
BASE-NEUTRALS	BUTYL BENZYL PHTHALATE	UG/L	156	85	46	110		14	47
	DI-N-BUTYL PHTHALATE	UG/L	15	26		N-D		4	50
	DIETHYL PHTHALATE	UG/L	43	N-D		N-D		N-D	N-D
	1,2-BENZANTHRACENE	UG/L	N-D	65		38		N-D	16
	CHRYSENE	UG/L	N-D	65		36		N-D	16
	ANTHRACENE	UG/L	79	47	41	5050		11	395
	FLUORENE	UG/L	28	N-D		100		N-D	N-D
	PHENANTHRENE	UG/L	79	47	41	5050		11	395
	PYRENE	UG/L	18	74		31		N-D	22
METALS	ANTIMONY	UG/L	41	108		10		8	20
	ARSENIC	UG/L	41	27	34	14		2	23
	BERYLLIUM	UG/L	4	4		4		2	4
	CADMIUM	UG/L	875	190	78	660		24	244
	CHROMIUM	UG/L	7617	1600	79	6450		175	2800
	COPPER	UG/L	16200	7150	56	7950		565	4400
	CYANIDE	UG/L	51600	69187		1675		440	2445
	LEAD	UG/L	7150	6150	14	4450		288	2600
	MERCURY	NG/L	92633	44500	52	34000	L	12000	16600
	NICKEL	UG/L	2517	340	66	1350		28	560
	SELENIUM	UG/L	176	230		111		29	225
	SILVER	UG/L	506	45	91	265		92	550
	ZINC	UG/L	45700	21500	53	16350		1903	6600

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 10

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	13958	2735	1347	1388	29.9
	TOTAL SUSP. SOLIDS	12815	8955	808	8147	69.3
	OIL & GREASE	4318	1032	958	73.7	7.0
NON-CONVENTIONALS	TOTAL PHENOLS	3.7	6.8	6.7	.1	L 0.1
	TOTAL SOLIDS	49091	42293	35952	6341	155
	TOTAL DISS. SOLIDS	36553	-	34213	NOT RUN	105
	TOTAL VOLATILE SOLIDS	16106	12466	7424	5042	75.0
	AMMONIA NITROGEN	1397	1120	1108	12.3	3.1
	TOC	6581	6743	2679	4064	35.8
VOLATILES	BENZENE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	CARBON TETRACHLORIDE	L 0.1	N-D	N-D	N-D	N-D
	CHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	.2	N-D	N-D	N-D	N-D
	1,1-DICHLOROETHANE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	1,1,2,2-TETRACHLOROETHANE	N-D	N-D	N-D	N-D	L 0.1
	CHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	CHLOROFORM	.5	.1	.1	N-D	L 0.1
	1,1-DICHLOROETHYLENE	N-D	N-D	N-D	N-D	L 0.1
	1,2-TRANS-DICHLOROETHYLENE	N-D	.1	N-D	.1	N-D
	1,2-DICHLOROPROPANE	L 0.1	L 0.1	N-D	L 0.1	N-D
	ETHYLBENZENE	.2	L 0.1	N-D	L 0.1	L 0.1
	METHYLENE CHLORIDE	4.6	2.9	2.9	L 0.1	L 0.1
	METHYL CHLORIDE	2.9	N-D	N-D	N-D	N-D
	DICHLORODIFLUOROMETHANE	N-D	N-D	N-D	N-D	L 0.1
	TETRACHLOROETHYLENE	.3	.2	.2	L 0.1	L 0.1
	TOLUENE	.7	.8	L 0.1	.8	L 0.1
	TRICHLOROETHYLENE	3.2	L 0.1	N-D	L 0.1	L 0.1
	VINYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	N-D
ACID EXTRACT	PHENOL	.5	L 0.1	L 0.1	L 0.1	N-D
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	L 0.1	N-D	N-D	N-D	N-D
	HEXACHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	N-D
	1,2-DICHLOROBENZENE	.2	N-D	N-D	N-D	N-D
	1,3-DICHLOROBENZENE	L 0.1	N-D	N-D	N-D	N-D
	1,4-DICHLOROBENZENE	.2	N-D	N-D	N-D	N-D
	NAPHTHALENE	.1	N-D	N-D	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	5.0	1.4	.5	.9	L 0.1
	BUTYL BENZYL PHTHALATE	.2	L 0.1	N-D	L 0.1	L 0.1
	DI-N-BUTYL PHTHALATE	.3	.4	.4	L 0.1	L 0.1
	DIETHYL PHTHALATE	.2	N-D	N-D	N-D	N-D
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	L 0.1	N-D
	11,12-BENZOFLUORANTHENE	L 0.1	N-D	N-D	N-D	N-D
	CHRYSENE	N-D	L 0.1	N-D	L 0.1	N-D
	ANTHRACENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,12-BENZOPERYLENE	N-D	L 0.1	L 0.1	N-D	N-D
	PHENANTHRENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	PYRENE	N-D	L 0.1	N-D	L 0.1	N-D

BALANCE AROUND TRICKLING FILTER PLANT ONLY
SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 10

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
PESTICIDES	DIELDRIN	N-D	L 0.1	L 0.1	N-D	N-D
	4,4'-DDD	N-D	L 0.1	L 0.1	N-D	N-D
	BETA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1	L 0.1
	ARSENIC	N-D	L 0.1	N-D	L 0.1	L 0.1
	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	.1	.3	.3	L 0.1	L 0.1
	CHROMIUM	.9	.7	.3	.4	L 0.1
	COPPER	4.2	2.4	.6	1.8	L 0.1
	CYANIDE	47.5	27.1	9.8	17.3	L 0.1
	LEAD	1.9	1.7	.2	1.5	L 0.1
	MERCURY	L 0.1	L 0.1	L 0.1	L 0.1	N-D
	NICKEL	.2	.7	.6	L 0.1	L 0.1
	SELENIUM	N-D	L 0.1	N-D	L 0.1	L 0.1
	SILVER	.5	L 0.1	L 0.1	L 0.1	L 0.1
	ZINC	12.0	8.6	3.2	5.4	.2
NON-CONV. METALS	ALUMINUM	56.2	-	2.5	NOT RUN	NOT RUN
	BARIUM	4.5	-	.8	NOT RUN	NOT RUN
	CALCIUM	2319	-	2040	NOT RUN	NOT RUN
	IRON	41.1	-	4.6	NOT RUN	NOT RUN
	MAGNESIUM	1212	-	1039	NOT RUN	NOT RUN
	MANGANESE	5.7	-	5.2	NOT RUN	NOT RUN
	SODIUM	6273	-	5542	NOT RUN	NOT RUN

BALANCE AROUND TRICKLING FILTER PLANT ONLY
SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 10

PARAMETER	INFL-UENT	PRECL EFFL	SEC. EFFL	T.F. EFFL	DIG. SLDG	SEC. SLDG	WAS+ SCUM	T.F. SLDG	COMB. SLDG
CHLOROFORM	100 (6)	67 (6)	83 (6)	83 (6)	50 (6)	0 (2)	0 (2)	25 (4)	0 (4)
METHYLENE CHLORIDE	100 (6)	100 (6)	100 (6)	100 (6)	0 (6)	0 (2)	0 (2)	100 (4)	100 (4)
TETRACHLOROETHYLENE	100 (6)	83 (6)	83 (6)	100 (6)	0 (6)	50 (2)	0 (2)	100 (4)	25 (4)
TOLUENE	100 (6)	0 (6)	0 (6)	17 (6)	100 (6)	100 (2)	100 (2)	75 (4)	100 (4)
TRICHLOROETHYLENE	100 (6)	0 (6)	0 (6)	0 (6)	17 (6)	50 (2)	0 (2)	100 (4)	50 (4)
PHENOL	100 (6)	0 (6)	0 (6)	17 (6)	67 (6)	0 (2)	50 (2)	0 (4)	50 (4)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (2)	100 (1)	100 (4)	75 (4)
BUTYL BENZYL PHTHALATE	100 (6)	0 (6)	0 (6)	0 (6)	17 (6)	50 (2)	50 (2)	25 (4)	25 (4)
COPPER	100 (6)	0 ( )	67 (6)	100 (6)	100 (6)	50 (2)	100 (2)	100 (4)	50 (2)
CYANIDE	100 (5)	0 ( )	100 (5)	100 (5)	100 (5)	100 (2)	100 (2)	100 (3)	100 (3)
MERCURY	100 (6)	0 ( )	40 (5)	17 (6)	100 (6)	100 (2)	100 (2)	0 (4)	100 (2)
ZINC	100 (6)	0 ( )	100 (6)	100 (6)	100 (6)	50 (2)	100 (2)	100 (4)	50 (2)
1,1,1-TRICHLOROETHANE	83 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
ETHYLBENZENE	83 (6)	0 (6)	0 (6)	0 (6)	100 (6)	0 (2)	100 (2)	50 (4)	100 (4)
1,4-DICHLOROBENZENE	83 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
GAMMA-BHC	83 (6)	17 (6)	67 (6)	83 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
CHROMIUM	83 (6)	0 ( )	100 (6)	67 (6)	100 (6)	50 (2)	100 (2)	75 (4)	50 (2)
SILVER	83 (6)	0 ( )	33 (6)	17 (6)	100 (6)	50 (2)	100 (2)	100 (4)	50 (2)
1,1-DICHLOROETHANE	67 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	25 (4)	100 (4)
METHYL CHLORIDE	67 (6)	0 (6)	17 (6)	0 (6)	17 (6)	50 (2)	0 (2)	0 (4)	0 (4)
NAPHTHALENE	67 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (2)	0 (2)	0 (4)	0 (4)
DI-N-BUTYL PHTHALATE	67 (6)	100 (6)	100 (6)	100 (6)	17 (6)	0 (2)	50 (2)	25 (4)	25 (4)
DIETHYL PHTHALATE	67 (6)	33 (6)	0 (6)	0 (6)	33 (6)	0 (2)	0 (2)	0 (4)	0 (4)
LEAD	67 (6)	0 ( )	17 (6)	17 (6)	100 (6)	100 (2)	100 (2)	100 (4)	100 (2)
1,2-DICHLOROBENZENE	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
CADMIUM	50 (6)	0 ( )	33 (6)	17 (6)	100 (6)	50 (2)	100 (2)	75 (4)	50 (2)
1,2,4-TRICHLOROBENZENE	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
NICKEL	33 (6)	0 ( )	83 (6)	50 (6)	100 (6)	50 (2)	100 (2)	75 (4)	50 (2)
BENZENE	17 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (2)	100 (2)	25 (4)	100 (4)
CARBON TETRACHLORIDE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
CHLOROETHANE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	50 (2)	0 (4)	0 (4)
1,2-DICHLOROPROPANE	17 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (2)	0 (2)	0 (4)	25 (4)
1,3-DICHLOROBENZENE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
11,12-BENZOFLUORANTHENE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
ACRYLONITRILE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)	0 (2)	0 (4)	0 (4)
CHLOROBENZENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (2)	0 (2)	0 (4)	50 (4)
1,1,2,2-TETRACHLOROETHANE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	25 (4)	0 (4)
1,1-DICHLOROETHYLENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	25 (4)	0 (4)
1,2-TRANS-DICHLOROETHYLENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	0 (2)	100 (2)	0 (4)	75 (4)
METHYL BROMIDE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	100 (2)	100 (2)	0 (4)	0 (4)
DICHLOROBROMOMETHANE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (2)	0 (2)	0 (4)	0 (4)
DICHLORODIFLUOROMETHANE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	100 (4)	0 (4)
VINYL CHLORIDE	0 (6)	0 (6)	17 (6)	0 (6)	67 (6)	0 (2)	0 (2)	0 (4)	75 (4)
ACENAPHTHENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	50 (2)	0 (4)	0 (4)
HEXACHLOROBENZENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	25 (4)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (2)	50 (2)	0 (4)	0 (4)
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)	50 (2)	0 (4)	25 (4)
CHRYSENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)	50 (2)	0 (4)	25 (4)
ANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)	50 (2)	100 (2)	25 (4)	50 (4)
1,12-BENZOPERYLENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
FLUORENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	50 (2)	0 (2)	0 (4)	0 (4)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 10

PARAMETER	INFL-UENT	PRECL EFFL	SEC. EFFL	T.F. EFFL	DIG. SLDG	SEC. SLDG	WAS+ SCUM	T.F. SLDG	COMB. SLDG
PHENANTHRENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)	50 (2)	100 (2)	25 (4)	50 (4)
PYRENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	50 (2)	50 (2)	0 (4)	50 (4)
DIELDRIN	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
4,4'-DDD	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
ALPHA-BHC	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
BETA-BHC	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (2)	0 (2)	0 (4)	0 (4)
ANTIMONY	0 (6)	0 ( )	0 (6)	0 (6)	100 (6)	50 (2)	100 (2)	25 (4)	100 (2)
ARSENIC	0 (6)	0 ( )	0 (6)	0 (6)	100 (6)	50 (2)	100 (2)	25 (4)	100 (2)
BERYLLIUM	0 (6)	0 ( )	0 (6)	0 (6)	50 (6)	50 (2)	50 (2)	25 (4)	50 (2)
SELENIUM	0 (6)	0 ( )	0 (6)	0 (6)	100 (6)	100 (2)	100 (2)	100 (4)	100 (2)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 11

FRACTION	PARAMETER	UNITS	INFLUENT	PRE-CL EFFLUENT	PCNT REM.	SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	99	27	73	NOT RUN	5555	1315
	TOTAL SUSP. SOLIDS	MG/L	171	14	92	NOT RUN	78250	1396
	OIL & GREASE	MG/L	66	9	86	NOT RUN	773	33
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	292	68	77	NOT RUN	322	20
	TOTAL SOLIDS	MG/L	1320	1166	12	NOT RUN	35600	2122
	TOTAL DISS. SOLIDS	MG/L	1127	1109	2	NOT RUN	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	MG/L	292	203	30	NOT RUN	26238	886
	AMMONIA NITROGEN	MG/L	18	10	44	NOT RUN	51	16
	TOC	MG/L	72	30	58	NOT RUN	8778	370
VOLATILES	BENZENE	UG/L	33	1	97	2	401	2
	CARBON TETRACHLORIDE	UG/L	L 5	L 5		2	N-D	N-D
	CHLOROBENZENE	UG/L	L 5	L 5		L 5	125	6
	1,1,1-TRICHLOROETHANE	UG/L	170	12	93	13	N-D	N-D
	1,1-DICHLOROETHANE	UG/L	6	0	100	0	223	70
	CHLOROETHANE	UG/L	L 5	L 5		L 5	517	N-D
	CHLOROFORM	UG/L	5	1	80	1	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	5	0	100	0	744	17
	1,3-DICHLOROPROPYLENE	UG/L	L 5	L 5		L 5	N-D	3
	ETHYLBENZENE	UG/L	10	1	90	1	193	11
	METHYLENE CHLORIDE	UG/L	90	21	77	30	1055	33
	METHYL CHLORIDE	UG/L	L 5	L 5		L 5	94	5
	DICHLOROBROMOMETHANE	UG/L	L 5	L 5		0	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	L 5	L 5		L 5	3	0
	TETRACHLOROETHYLENE	UG/L	55	7	87	11	2	1
	TOLUENE	UG/L	50	2	96	7	503	8
	TRICHLOROETHYLENE	UG/L	73	3	96	5	4	5
ACID EXTRACT	2,4-DIMETHYLPHENOL	UG/L	2	L 25		L 25	N-D	N-D
	PHENOL	UG/L	15	L 30		L 30	173	300
BASE-NEUTRALS	ACENAPHTHENE	UG/L	L 10	L 10		L 10	153	N-D
	HEXACHLOROBENZENE	UG/L	4	3	25	0	N-D	N-D
	1,2-DICHLOROBENZENE	UG/L	L 10	0		L 10	N-D	N-D
	NAPHTHALENE	UG/L	3	L 10		L 10	32	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	52	59		51	3883	924
	BUTYL BENZYL PHTHALATE	UG/L	1	L 10		0	213	N-D
	DI-N-BUTYL PHTHALATE	UG/L	4	2	50	2	41	N-D
	DIETHYL PHTHALATE	UG/L	2	1	50	0	N-D	N-D
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		L 5	22	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 11

FRACTION	PARAMETER	UNITS		INFLUENT		PRE-CL EFFLUENT	PCNT REM.		SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	CHRYSENE	UG/L	L	5	L	5		L	5	22	N-D
	ANTHRACENE	UG/L		8	L	10		L	10	272	N-D
	PHENANTHRENE	UG/L		8	L	10		L	10	272	N-D
PESTICIDES	ALDRIN	NG/L		2		1	50		4	N-D	N-D
	HEPTACHLOR	NG/L	L	1000	L	1000			0	N-D	N-D
	ALPHA-BHC	NG/L		1	L	1000		L	1000	N-D	N-D
	BETA-BHC	NG/L		6	L	1000		L	1000	N-D	N-D
	GAMMA-BHC	NG/L	L	1000	L	1000			0	N-D	N-D
METALS	ANTIMONY	UG/L		1		3			NOT RUN	98	25
	ARSENIC	UG/L		29		32			NOT RUN	175	12
	CADMIUM	UG/L		9		8	11		NOT RUN	498	29
	CHROMIUM	UG/L		152		45	70		NOT RUN	29950	1263
	COPPER	UG/L		245		62	75		NOT RUN	47917	1517
	CYANIDE	UG/L		713		306	57		NOT RUN	176667	497
	LEAD	UG/L		159		127	20		NOT RUN	8417	682
	MERCURY	NG/L		667		167	75		NOT RUN	331667	8167
	NICKEL	UG/L		64		49	23		NOT RUN	3933	48
	SELENIUM	UG/L		4		3	25		NOT RUN	104	10
	SILVER	UG/L		19		7	63		NOT RUN	493	170
	ZINC	UG/L		196		97	51		NOT RUN	40867	1185
NON-CONV. METALS	ALUMINUM	UG/L		903		314	65		NOT RUN	NOT RUN	NOT RUN
	BARIUM	UG/L		178		53	70		NOT RUN	NOT RUN	NOT RUN
	BORON	UG/L		223		252			NOT RUN	NOT RUN	NOT RUN
	CALCIUM	MG/L		90		81	10		NOT RUN	NOT RUN	NOT RUN
	COBALT	UG/L		86		113			NOT RUN	NOT RUN	NOT RUN
	IRON	UG/L		961		215	78		NOT RUN	NOT RUN	NOT RUN
	MAGNESIUM	MG/L		36		89			NOT RUN	NOT RUN	NOT RUN
	MANGANESE	UG/L		52		40	23		NOT RUN	NOT RUN	NOT RUN
	MOLYBDENUM	UG/L		69		90			NOT RUN	NOT RUN	NOT RUN
	SODIUM	MG/L		206		204	2		NOT RUN	NOT RUN	NOT RUN
	TIN	UG/L		104		83	20		NOT RUN	NOT RUN	NOT RUN
	TITANIUM	UG/L		14		5	64		NOT RUN	NOT RUN	NOT RUN
	VANADIUM	UG/L		9		9			NOT RUN	NOT RUN	NOT RUN
	YTTRIUM	UG/L		1		22			NOT RUN	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 11

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	PRE-CL EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	31622	14148	8595	5553	657
	TOTAL SUSP. SOLIDS	54841	82762	4543	78219	698
	OIL & GREASE	21113	3595	2822	773	16.4
NON-CONVENTIONALS	TOTAL PHENOLS	93.5	22.0	21.7	.3	L 0.1
	TOTAL SOLIDS	423224	409421	373835	35586	1060
	TOTAL DISS. SOLIDS	361488	-	355608	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	93592	91170	64943	26227	443
	AMMONIA NITROGEN	5666	3098	3047	50.6	8.1
	TOC	23198	18342	9568	8774	185
VOLATILES	BENZENE	10.7	.6	.2	.4	L 0.1
	CHLOROBENZENE	N-D	.1	N-D	.1	L 0.1
	1,1,1-TRICHLOROETHANE	54.4	4.0	4.0	N-D	N-D
	1,1-DICHLOROETHANE	1.9	.3	.1	.2	L 0.1
	CHLOROETHANE	N-D	.5	N-D	.5	N-D
	CHLOROFORM	1.4	.4	.4	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	1.6	.8	L 0.1	.7	L 0.1
	1,3-DICHLOROPROPYLENE	N-D	N-D	N-D	N-D	L 0.1
	ETHYLBENZENE	3.3	.5	.3	.2	L 0.1
	METHYLENE CHLORIDE	28.9	7.8	6.7	1.1	L 0.1
	METHYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	L 0.1
	TRICHLOROFLUOROMETHANE	N-D	L 0.1	N-D	L 0.1	L 0.1
	TETRACHLOROETHYLENE	17.6	2.4	2.4	L 0.1	L 0.1
	TOLUENE	16.0	1.0	.5	.5	L 0.1
	TRICHLOROETHYLENE	23.5	1.0	1.0	L 0.1	L 0.1
ACID EXTRACT	2,4-DIMETHYLPHENOL	.5	N-D	N-D	N-D	N-D
	PHENOL	4.7	.2	N-D	.2	.1
BASE-NEUTRALS	ACENAPHTHENE	N-D	.2	N-D	.2	N-D
	HEXACHLOROBENZENE	1.1	.9	.9	N-D	N-D
	1,2-DICHLOROBENZENE	N-D	L 0.1	L 0.1	N-D	N-D
	NAPHTHALENE	1.1	L 0.1	N-D	L 0.1	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	16.6	22.7	18.8	3.9	.5
	BUTYL BENZYL PHTHALATE	.2	.2	N-D	.2	N-D
	DI-N-BUTYL PHTHALATE	1.4	.5	.5	L 0.1	N-D
	DIETHYL PHTHALATE	.6	.2	.2	N-D	N-D
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	L 0.1	N-D
	CHRYSENE	N-D	L 0.1	N-D	L 0.1	N-D
	ANTHRACENE	2.5	.3	N-D	.3	N-D
	PHENANTHRENE	2.5	.3	N-D	.3	N-D
PESTICIDES	ALDRIN	.5	.4	.4	N-D	N-D
	ALPHA-BHC	.2	N-D	N-D	N-D	N-D
	BETA-BHC	L 0.1	N-D	N-D	N-D	N-D
METALS	ANTIMONY	.4	1.1	1.0	L 0.1	L 0.1
	ARSENIC	9.2	10.5	10.3	.2	L 0.1
	CADMIUM	2.7	3.0	2.5	.5	L 0.1
	CHROMIUM	48.8	44.2	14.3	29.9	.6

SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 11

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	PRE-CL EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
METALS	COPPER	78.5	67.7	19.8	47.9	.8
	CYANIDE	229	278	98.7	179	.2
	LEAD	50.8	49.0	40.6	8.4	.3
	MERCURY	.2	.4	L 0.1	.3	L 0.1
	NICKEL	20.5	19.5	15.6	3.9	L 0.1
	SELENIUM	1.1	1.0	.9	.1	L 0.1
	SILVER	6.1	2.7	2.2	.5	L 0.1
	ZINC	62.9	72.0	31.1	40.9	.6
NON-CONV. METALS	ALUMINUM	290	-	101	NOT RUN	NOT RUN
	BARIUM	57.1	-	17.1	NOT RUN	NOT RUN
	BORON	71.4	-	80.9	NOT RUN	NOT RUN
	CALCIUM	28863	-	25924	NOT RUN	NOT RUN
	COBALT	28.1	-	37.8	NOT RUN	NOT RUN
	IRON	308	-	68.9	NOT RUN	NOT RUN
	MAGNESIUM	11599	-	28596	NOT RUN	NOT RUN
	MANGANESE	16.8	-	12.7	NOT RUN	NOT RUN
	MOLYBDENUM	22.1	-	28.8	NOT RUN	NOT RUN
	SODIUM	66814	-	65424	NOT RUN	NOT RUN
	TIN	33.4	-	26.7	NOT RUN	NOT RUN
	TITANIUM	4.5	-	1.7	NOT RUN	NOT RUN
	VANADIUM	2.8	-	2.8	NOT RUN	NOT RUN
	YTTRIUM	.2	-	6.9	NOT RUN	NOT RUN

SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 11

PARAMETER	INFL-UENT	PRE CL. EFFL	SEC. EFFL	COMB. SLDG	SEC. SLDG
1,1,1-TRICHLOROETHANE	100 (6)	100 (6)	100 (6)	0 (6)	0 (6)
1,1-DICHLOROETHANE	100 (6)	33 (6)	17 (6)	100 (6)	100 (6)
TETRACHLOROETHYLENE	100 (6)	100 (6)	100 (6)	67 (6)	67 (6)
TOLUENE	100 (6)	50 (6)	100 (6)	100 (6)	100 (6)
TRICHLOROETHYLENE	100 (6)	100 (6)	100 (6)	67 (6)	67 (6)
DI-N-BUTYL PHTHALATE	100 (6)	67 (6)	83 (6)	33 (6)	0 (6)
ANTHRACENE	100 (6)	0 (6)	0 (6)	33 (6)	0 (6)
PHENANTHRENE	100 (6)	0 (6)	0 (6)	33 (6)	0 (6)
ANTIMONY	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
ARSENIC	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
CADMIUM	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
CHROMIUM	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
COPPER	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
CYANIDE	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
LEAD	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
NICKEL	100 (6)	100 (6)	0 ( )	100 (6)	17 (6)
SELENIUM	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
SILVER	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
ZINC	100 (6)	100 (6)	0 ( )	100 (6)	100 (6)
BENZENE	83 (6)	67 (6)	100 (6)	100 (6)	83 (6)
1,2-TRANS-DICHLOROETHYLENE	83 (6)	17 (6)	17 (6)	100 (6)	17 (6)
ETHYLBENZENE	83 (6)	33 (6)	83 (6)	100 (6)	33 (6)
METHYLENE CHLORIDE	83 (6)	83 (6)	67 (6)	83 (6)	67 (6)
PHENOL	83 (6)	0 (6)	0 (6)	50 (6)	17 (6)
NAPHTHALENE	83 (6)	0 (6)	0 (6)	17 (6)	0 (6)
BIS(2-ETHYLHEXYL) PHTHALATE	83 (6)	100 (6)	100 (6)	100 (6)	100 (6)
CHLOROFORM	67 (6)	83 (6)	33 (6)	0 (6)	0 (6)
DIETHYL PHTHALATE	67 (6)	33 (6)	33 (6)	0 (6)	0 (6)
2,4-DIMETHYLPHENOL	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)
HEXACHLOROBENZENE	33 (6)	33 (6)	17 (6)	0 (6)	0 (6)
ALDRIN	33 (6)	50 (6)	83 (6)	0 (6)	0 (6)
MERCURY	33 (6)	17 (6)	0 ( )	100 (6)	67 (6)
BUTYL BENZYL PHTHALATE	17 (6)	0 (6)	17 (6)	33 (6)	0 (6)
ALPHA-BHC	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)
BETA-BHC	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)
CARBON TETRACHLORIDE	0 (6)	0 (6)	33 (6)	0 (6)	0 (6)
CHLOROBENZENE	0 (6)	0 (6)	0 (6)	67 (6)	50 (6)
CHLOROETHANE	0 (6)	0 (6)	0 (6)	83 (6)	0 (6)
1,3-DICHLOROPROPYLENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)
METHYL CHLORIDE	0 (6)	0 (6)	0 (6)	50 (6)	33 (6)
DICHLOROBROMOMETHANE	0 (6)	0 (6)	17 (6)	0 (6)	0 (6)
TRICHLOROFLUOROMETHANE	0 (6)	0 (6)	0 (6)	17 (6)	17 (6)
ACENAPHTHENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)
1,2-DICHLOROBENZENE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)
CHRYSENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)
HEPTACHLOR	0 (6)	0 (6)	17 (6)	0 (6)	0 (6)
GAMMA-BHC	0 (6)	0 (6)	33 (6)	0 (6)	0 (6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 12

FRACTION	PARAMETER	UNITS	INFLULNT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	105	10	90	75	959	2563
	TOTAL SUSP. SOLIDS	MG/L	178	14	92	90	4150	9825
	COD	MG/L	372	107	71	257	4773	12240
	OIL & GREASE	MG/L	46	9	80	33	NOT RUN	NOT RUN
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	38	20	47	83	51	50
	TOTAL SOLIDS	MG/L	1055	835	21	940	4434	9043
	TOTAL DISS. SOLIDS	MG/L	830	813	2	844	5333	NOT RUN
	SETTLEABLE SOLIDS	ML/L	8	0	100	1	68	521
	TOTAL VOLATILE SOLIDS	MG/L	318	196	38	233	2961	6394
	VOLATILE DISS. SOLIDS	MG/L	192	184	4	212	2533	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	90	9	90	61	2942	6375
	AMMONIA NITROGEN	MG/L	18	13	28	17	31	24
	TOC	MG/L	59	17	71	50	508	1683
VOLATILES	BENZENE	UG/L	L 1	L 1		L 1	2	1
	CARBON TETRACHLORIDE	UG/L	L 1	L 1		1	N-D	N-D
	CHLOROBENZENE	UG/L	L 1	L 1		L 1	1	1
	1,2-DICHLOROETHANE	UG/L	L 1	L 1		L 1	1	N-D
	1,1,1-TRICHLOROETHANE	UG/L	64	10	84	34	0	N-D
	1,1-DICHLOROETHANE	UG/L	1	L 1		1	23	0
	1,1,2-TRICHLOROETHANE	UG/L	L 1	L 1		L 1	0	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		L 1	N-D	1
	CHLOROETHANE	UG/L	1	L 10		L 10	7	N-D
	CHLOROFORM	UG/L	3	1	67	2	N-D	0
	1,2-TRANS-DICHLOROETHYLENE	UG/L	2	L 1	50	L 1	292	1
	1,2-DICHLOROPROPANE	UG/L	L 1	L 1		L 1	0	N-D
	ETHYLBENZENE	UG/L	10	L 1	90	5	24	N-D
	METHYLENE CHLORIDE	UG/L	41	22	46	58	11	3
	METHYL CHLORIDE	UG/L	L 10	L 10		L 10	2	N-D
	TRICHLOROFLUOROMETHANE	UG/L	L 1	L 1		L 1	5	1
	DICHLORODIFLUOROMETHANE	UG/L	L 10	L 10		L 10	6	N-D
	TETRACHLOROETHYLENE	UG/L	31	8	74	56	N-D	N-D
	TOLUENE	UG/L	23	7	70	36	113	14652
	TRICHLOROETHYLENE	UG/L	100	28	72	61	0	N-D
	VINYL CHLORIDE	UG/L	L 10	L 10		L 10	17	292
ACID EXTRACT	2-CHLOROPHENOL	UG/L	0	L 1		L 1	N-D	N-D
	PHENOL	UG/L	5	L 1	80	4	N-D	400
BASE-NEUTRALS	1,2-DIPHENYLHYDRAZINE	UG/L	2	L 10		L 10	N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 12

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	FLUORANTHENE	UG/L	L 3	L 3		L 3	4	7
	ISOPHORONE	UG/L	L 16	L 16		3	N-D	N-D
	NAPHTHALENE	UG/L	2	L 2		1	8	6
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	20	10	50	21	425	965
	BUTYL BENZYL PHTHALATE	UG/L	L 5	L 5		L 5	11	N-D
	DI-N-BUTYL PHTHALATE	UG/L	L 6	L 6		L 6	16	7
	DIETHYL PHTHALATE	UG/L	L 6	L 6		L 6	10	47
	1,2-BENZANTHRACENE	UG/L	L 3	L 3		L 3	N-D	13
	CHRYSENE	UG/L	L 3	L 3		L 3	N-D	13
	ANTHRACENE	UG/L	L 3	L 3		1	37	5
	PHENANTHRENE	UG/L	L 3	L 3		1	37	5
	PYRENE	UG/L	L 3	L 3		L 3	11	39
PESTICIDES	ALPHA-BHC	NG/L	30	5	83	33	N-D	N-D
	GAMMA-BHC	NG/L	37	27	27	39	N-D	N-D
METALS	ANTIMONY	UG/L	145	42	71	266	1113	1297
	ARSENIC	UG/L	L 50	L 50		147	11	19
	BERYLLIUM	UG/L	L 2	L 2		153	L 6	L 6
	CADMIUM	UG/L	174	15	91	251	970	10046
	CHROMIUM	UG/L	414	48	88	440	3217	28820
	COPPER	UG/L	922	86	91	688	6183	44540
	CYANIDE	UG/L	891	375	58	177	2940	3370
	LEAD	UG/L	58	24	59	185	122	400
	MERCURY	NG/L	517	L 200	61	533	8333	17167
	NICKEL	UG/L	164	121	26	272	677	3172
	SELENIUM	UG/L	L 50	L 50		134	17	41
	SILVER	UG/L	4	L 2	50	2	80	144
	THALLIUM	UG/L	L 100	L 100		134	17	18
	ZINC	UG/L	1615	267	83	1100	12083	66580
NON-CONV. METALS	ALUMINUM	UG/L	366	36	90	329	NOT RUN	NOT RUN
	BARIUM	UG/L	244	94	61	329	NOT RUN	NOT RUN
	CALCIUM	MG/L	84	76	10	79	NOT RUN	NOT RUN
	IRON	UG/L	2888	257	91	1705	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	32	32		32	NOT RUN	NOT RUN
	MANGANESE	UG/L	109	77	29	248	NOT RUN	NOT RUN
	SODIUM	MG/L	145	140	3	143	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN;   N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 12

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	32695	13740	2968	4795	5977
	TOTAL SUSP. SOLIDS	55707	48031	4373	20742	22916
	COD	116203	85934	33528	23857	28549
	OIL & GREASE	14265	-	2759	NOT RUN	NOT RUN
NON-CONVENTIONALS	TOTAL PHENOLS	11.7	6.6	6.2	.3	.1
	TOTAL SOLIDS	329660	304033	260781	22159	21093
	TOTAL DISS. SOLIDS	259209	-	253805	26654	NOT RUN
	TOTAL VOLATILE SOLIDS	99231	91458	61746	14798	14914
	VOLATILE DISS. SOLIDS	59976	-	57415	12660	NOT RUN
	TOTAL VOL. SUS. SOLIDS	28062	32330	2759	14702	14869
	AMMONIA NITROGEN	5623	4118	3905	157	56.4
	TOC	18482	11829	5362	2541	3926
VOLATILES	ACRYLONITRILE	N-D	L 0.1	N-D	N-D	L 0.1
	BENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	CHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	1,2-DICHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	19.8	3.1	3.1	L 0.1	N-D
	1,1-DICHLOROETHANE	.2	.1	N-D	.1	L 0.1
	1,1,2-TRICHLOROETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,2,2-TETRACHLOROETHANE	N-D	L 0.1	N-D	N-D	L 0.1
	CHLOROETHANE	.3	L 0.1	N-D	L 0.1	N-D
	CHLOROFORM	.9	.3	.3	N-D	L 0.1
	1,2-TRANS-DICHLOROETHYLENE	.5	1.5	N-D	1.5	L 0.1
	1,2-DICHLOROPROPANE	N-D	L 0.1	N-D	L 0.1	N-D
	ETHYLBENZENE	3.2	.1	N-D	.1	N-D
	METHYLENE CHLORIDE	12.7	7.0	6.9	L 0.1	L 0.1
	METHYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	N-D
	TRICHLOROFLUOROMETHANE	N-D	L 0.1	N-D	L 0.1	L 0.1
	DICHLORODIFLUOROMETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	TETRACHLOROETHYLENE	9.6	2.4	2.4	N-D	N-D
	TOLUENE	7.3	37.0	2.2	.6	34.2
	TRICHLOROETHYLENE	31.2	8.6	8.6	L 0.1	N-D
	VINYL CHLORIDE	N-D	.8	N-D	L 0.1	.7
ACID EXTRACT	2-CHLOROPHENOL	.1	N-D	N-D	N-D	N-D
	PHENOL	1.5	.9	N-D	N-D	.9
BASE-NEUTRALS	1,2-DIPHENYLHYDRAZINE	.5	N-D	N-D	N-D	N-D
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	NAPHTHALENE	.5	L 0.1	N-D	L 0.1	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	6.1	7.4	3.0	2.1	2.3
	BUTYL BENZYL PHTHALATE	N-D	L 0.1	N-D	L 0.1	N-D
	DI-N-BUTYL PHTHALATE	N-D	L 0.1	N-D	L 0.1	L 0.1
	DIETHYL PHTHALATE	N-D	.2	N-D	L 0.1	.1
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	N-D	L 0.1
	CHRYSENE	N-D	L 0.1	N-D	N-D	L 0.1
	ANTHRACENE	N-D	.2	N-D	.2	L 0.1
	PHENANTHRENE	N-D	.2	N-D	.2	L 0.1
	PYRENE	N-D	.2	N-D	L 0.1	L 0.1

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 12

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
PESTICIDES	ALPHA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
METALS	ANTIMONY	45.3	21.6	13.0	5.6	3.0
	ARSENIC	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	54.3	32.8	4.6	4.8	23.4
	CHROMIUM	129	98.2	14.9	16.1	67.2
	COPPER	288	162	26.9	30.9	104
	CYANIDE	278	140	117	14.7	7.9
	LEAD	18.1	8.9	7.4	.6	.9
	MERCURY	.2	L 0.1	N-D	L 0.1	L 0.1
	NICKEL	51.1	48.5	37.7	3.4	7.4
	SELENIUM	N-D	.2	N-D	L 0.1	L 0.1
	SILVER	1.3	.7	N-D	.4	.3
	THALLIUM	N-D	.1	N-D	L 0.1	L 0.1
	ZINC	504	299	83.5	60.4	155
NON-CONV. METALS	ALUMINUM	114	-	11.2	NOT RUN	NOT RUN
	BARIUM	76.1	-	29.4	NOT RUN	NOT RUN
	CALCIUM	26135	-	23688	NOT RUN	NOT RUN
	IRON	902	-	80.4	NOT RUN	NOT RUN
	MAGNESIUM	10100	-	9944	NOT RUN	NOT RUN
	MANGANESE	34.2	-	23.9	NOT RUN	NOT RUN
	SODIUM	45190	-	43837	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 12

PARAMETER	INFL-UENT	PRIM. EFFL	SEC. EFFL	PRIM. SLDG	SEC. SLDG
1,1,1-TRICHLOROETHANE	100 (6)	100 (5)	100 (6)	33 (6)	0 (6)
CHLOROFORM	100 (6)	100 (5)	100 (6)	0 (6)	17 (6)
ETHYLBENZENE	100 (6)	100 (5)	0 (6)	83 (6)	0 (6)
METHYLENE CHLORIDE	100 (6)	100 (5)	100 (6)	100 (6)	17 (6)
TETRACHLOROETHYLENE	100 (6)	100 (5)	100 (6)	0 (6)	0 (6)
TOLUENE	100 (6)	100 (5)	67 (6)	100 (6)	100 (6)
PHENOL	100 (6)	83 (6)	0 (6)	0 (6)	17 (6)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)
ANTIMONY	100 (6)	100 (6)	67 (6)	100 (6)	100 (6)
CADMIUM	100 (6)	100 (6)	100 (6)	100 (6)	100 (5)
CHROMIUM	100 (6)	100 (6)	100 (6)	100 (6)	100 (5)
COPPER	100 (6)	100 (6)	100 (6)	100 (6)	100 (5)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)
LEAD	100 (6)	100 (6)	33 (6)	17 (6)	17 (6)
MERCURY	100 (6)	83 (6)	0 (6)	83 (6)	100 (6)
NICKEL	100 (6)	100 (6)	100 (6)	100 (6)	100 (5)
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (5)
TRICHLOROETHYLENE	83 (6)	100 (5)	100 (6)	33 (6)	0 (6)
SILVER	83 (6)	50 (6)	0 (6)	100 (6)	100 (5)
1,1-DICHLOROETHANE	67 (6)	80 (5)	0 (6)	83 (6)	17 (6)
NAPHTHALENE	50 (6)	33 (6)	0 (6)	17 (6)	17 (6)
GAMMA-BHC	50 (6)	67 (6)	67 (6)	0 (6)	0 (6)
2-CHLOROPHENOL	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)
ALPHA-BHC	33 (6)	33 (6)	17 (6)	0 (6)	0 (6)
CHLOROETHANE	17 (6)	0 (5)	0 (6)	33 (6)	0 (6)
1,2-TRANS-DICHLOROETHYLENE	17 (6)	0 (5)	0 (6)	100 (6)	33 (6)
1,2-DIPHENYLHYDRAZINE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)
BENZENE	0 (6)	0 (5)	0 (6)	100 (6)	83 (6)
CARBON TETRACHLORIDE	0 (6)	20 (5)	0 (6)	0 (6)	0 (6)
CHLOROBENZENE	0 (6)	0 (5)	0 (6)	33 (6)	50 (6)
1,2-DICHLOROETHANE	0 (6)	0 (5)	0 (6)	50 (6)	0 (6)
1,1,2-TRICHLOROETHANE	0 (6)	0 (5)	0 (6)	17 (6)	0 (6)
1,1,2,2-TETRACHLOROETHANE	0 (6)	0 (5)	0 (6)	0 (6)	33 (6)
1,2-DICHLOROPROPANE	0 (6)	0 (5)	0 (6)	17 (6)	0 (6)
METHYL CHLORIDE	0 (6)	0 (5)	0 (6)	17 (6)	0 (6)
TRICHLOROFLUOROMETHANE	0 (6)	0 (5)	0 (6)	83 (6)	17 (6)
DICHLORODIFLUOROMETHANE	0 (6)	0 (5)	0 (6)	50 (6)	0 (6)
VINYL CHLORIDE	0 (6)	0 (5)	0 (6)	100 (6)	100 (6)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	33 (6)	33 (6)
ISOPHORONE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)
BUTYL BENZYL PHTHALATE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)
DI-N-BUTYL PHTHALATE	0 (6)	0 (6)	0 (6)	50 (6)	17 (6)
DIETHYL PHTHALATE	0 (6)	0 (6)	0 (6)	33 (6)	50 (6)
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)
CHRYSENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)
ANTHRACENE	0 (6)	17 (6)	0 (6)	50 (6)	17 (6)
PHENANTHRENE	0 (6)	17 (6)	0 (6)	50 (6)	17 (6)
PYRENE	0 (6)	0 (6)	0 (6)	50 (6)	83 (6)
ARSENIC	0 (6)	17 (6)	0 (6)	100 (6)	100 (6)
BERYLLIUM	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)
SELENIUM	0 (6)	17 (6)	0 (6)	100 (6)	100 (6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

```
                   PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

                                 PLANT 12

 PARAMETER                      INFL-     PRIM.     SEC.     PRIM.     SEC.
----------                      UENT      EFFL      EFFL     SLDG      SLDG
THALLIUM                        -----     -----     ----     -----     ----
                                  0 ( 6)  17  ( 6)   0 ( 6)  67  ( 6)  67 ( 6)
```

```
POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED
```

SUMMARY OF ANALYTICAL DATA

PLANT 13

FRACTION	PARAMETER	UNITS	INFLUENT	PRE-CL SECONDARY EFFLUENT	PCNT REM.	TERTIARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	69	15	78	10	8530	6784
	TOTAL SUSP. SOLIDS	MG/L	150	13	91	6	95000	38295
	COD	MG/L	265	49	82	36	53867	22267
	OIL & GREASE	MG/L	36	15	58	12	4225	617
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	27	15	44	17	251	44
	TOTAL SOLIDS	MG/L	891	739	17	720	58570	27410
	TOTAL DISS. SOLIDS	MG/L	706	695	2	722	12500	NOT RUN
	SETTLEABLE SOLIDS	ML/L	4	L 1	75	L 1	998	888
	TOTAL VOLATILE SOLIDS	MG/L	230	123	47	141	28143	15127
	VOLATILE DISS. SOLIDS	MG/L	194	130	33	170	3750	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	105	7	93	3	54250	77790
	AMMONIA NITROGEN	MG/L	17	2	88	1	153	13
	TOC	MG/L	49	9	82	9	8467	3650
VOLATILES	BENZENE	UG/L	L 1	L 1		L 1	13	4
	1,1,1-TRICHLOROETHANE	UG/L	1	L 1		L 1	N-D	N-D
	CHLOROFORM	UG/L	7	1	86	8	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	L 1	L 1		L 1	38	1
	ETHYLBENZENE	UG/L	3	L 1	67	L 1	24	N-D
	METHYLENE CHLORIDE	UG/L	3	0	100	1	56	25
	DICHLOROBROMOMETHANE	UG/L	L 1	L 1		3	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	L 1	L 1		L 1	43	17
	CHLORODIBROMOMETHANE	UG/L	L 1	L 1		1	N-D	N-D
	TETRACHLOROETHYLENE	UG/L	11	1	91	0	N-D	N-D
	TOLUENE	UG/L	10	L 1	90	L 1	8810	9522
	TRICHLOROETHYLENE	UG/L	6	L 1	83	L 1	N-D	N-D
ACID EXTRACT	2,4-DINITROPHENOL	UG/L	1	L 5		L 5	N-D	N-D
	PENTACHLOROPHENOL	UG/L	3	1	67	1	N-D	N-D
	PHENOL	UG/L	1	0	100	1	602	291
BASE-NEUTRALS	FLUORANTHENE	UG/L	L 3	L 3		L 3	113	33
	NAPHTHALENE	UG/L	L 2	L 2		L 2	12	43
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	12	9	25	14	3151	1679
	BUTYL BENZYL PHTHALATE	UG/L	L 3	L 3		L 3	270	278
	DI-N-BUTYL PHTHALATE	UG/L	2	2		2	178	15
	DIETHYL PHTHALATE	UG/L	L 3	L 3		L 3	N-D	7
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		L 5	87	N-D
	11,12-BENZOFLUORANTHENE	UG/L	L 10	L 10		L 10	36	N-D
	CHRYSENE	UG/L	L 5	L 5		L 5	87	N-D
	ANTHRACENE	UG/L	L 3	L 3		L 3	173	143
	FLUORENE	UG/L	L 3	L 3		L 3	20	N-D
	PHENANTHRENE	UG/L	L 3	L 3		L 3	173	143
	PYRENE	UG/L	L 3	L 3		L 3	138	32
PESTICIDES	GAMMA-BHC	NG/L	L 100	14		19	N-D	N-D
	PCB-1242	NG/L	25033	275	99	82	N-D	N-D
	PCB-1254	NG/L	1483	L 500	66	83	N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PERCENT REMOVAL BASED ON PRECHLORINATED SECONDARY EFFLUENT
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 13

FRACTION	PARAMETER	UNITS		INFLUENT		PRE-CL SECONDARY EFFLUENT	PCNT REM.		TERTIARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	ANTIMONY	UG/L	L	50	L	50		L	50	102	34
	ARSENIC	UG/L	L	50	L	50		L	50	378	192
	CADMIUM	UG/L	L	2	L	2		L	2	344	155
	CHROMIUM	UG/L		55		3	95	L	5	22217	9267
	COPPER	UG/L		117		24	79		36	33100	14767
	CYANIDE	UG/L		2122		555	74		6454	104117	29033
	LEAD	UG/L		58	L	20	66	L	20	26000	10467
	MERCURY	MG/L		67	L	200		L	200	86833	33000
	NICKEL	UG/L	L	10	L	10		L	10	6067	2110
	SELENIUM	UG/L	L	50	L	50		L	50	67	50
	SILVER	UG/L		9	L	2	78	L	2	303	918
	THALLIUM	UG/L	L	100	L	100		L	100	5	6
	ZINC	UG/L		233		30	87		35	106517	45317
NON-CONV. METALS	ALUMINUM	UG/L		2563		182	93		105	NOT RUN	NOT RUN
	BARIUM	UG/L		130		49	62		29	NOT RUN	NOT RUN
	CALCIUM	MG/L		88		80	9		80	NOT RUN	NOT RUN
	IRON	UG/L		2212		113	95		81	NOT RUN	NOT RUN
	MAGNESIUM	MG/L		34		32	6		31	NOT RUN	NOT RUN
	MANGANESE	UG/L		138		115	17		69	NOT RUN	NOT RUN
	SODIUM	MG/L		62		59	5		58	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PERCENT REMOVAL BASED ON PRECHLORINATED SECONDARY EFFLUENT
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 13

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	PRE-CL SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	8773	175430	1625	4263	169542
	TOTAL SUSP. SOLIDS	19075	1005946	1485	47481	956980
	COD	33732	588774	5407	26923	556444
	OIL & GREASE	4631	19228	1706	2112	15410
NON-CONVENTIONALS	TOTAL PHENOLS	3.4	2.9	1.7	.1	1.1
	TOTAL SOLIDS	113493	796071	81818	29273	684980
	TOTAL DISS. SOLIDS	90000	-	76943	6247	NOT RUN
	TOTAL VOLATILE SOLIDS	29250	405746	13646	14066	378034
	VOLATILE DISS. SOLIDS	24704	-	14421	1874	NOT RUN
	TOTAL VOL. SUS. SOLIDS	13382	1971884	798	27114	1943972
	AMMONIA NITROGEN	2124	555	166	76.6	312
	TOC	6224	96387	942	4232	91213
VOLATILES	BENZENE	N-D	.1	N-D	L 0.1	.1
	1,1,1-TRICHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	CHLOROFORM	.9	.1	.1	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	N-D	L 0.1	N-D	L 0.1	L 0.1
	ETHYLBENZENE	.3	L 0.1	N-D	L 0.1	N-D
	METHYLENE CHLORIDE	.3	.6	L 0.1	L 0.1	.6
	TRICHLOROFLUOROMETHANE	N-D	.4	N-D	L 0.1	.4
	TETRACHLOROETHYLENE	1.3	L 0.1	L 0.1	N-D	N-D
	TOLUENE	1.3	242	N-D	4.4	238
	TRICHLOROETHYLENE	.8	N-D	N-D	N-D	N-D
ACID EXTRACT	2,4-DINITROPHENOL	.1	N-D	N-D	N-D	N-D
	PENTACHLOROPHENOL	.4	L 0.1	L 0.1	N-D	N-D
	PHENOL	L 0.1	7.6	L 0.1	.3	7.3
BASE-NEUTRALS	FLUORANTHENE	N-D	.9	N-D	L 0.1	.8
	NAPHTHALENE	N-D	1.1	N-D	L 0.1	1.1
	BIS(2-ETHYLHEXYL) PHTHALATE	1.6	44.6	1.0	1.6	42.0
	BUTYL BENZYL PHTHALATE	N-D	7.0	N-D	.1	6.9
	DI-N-BUTYL PHTHALATE	.3	.8	.3	L 0.1	.4
	DIETHYL PHTHALATE	N-D	.2	N-D	N-D	.2
	1,2-BENZANTHRACENE	N-D	L 0.1	N-D	L 0.1	N-D
	11,12-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	CHRYSENE	N-D	L 0.1	N-D	L 0.1	N-D
	ANTHRACENE	N-D	3.7	N-D	L 0.1	3.6
	FLUORENE	N-D	L 0.1	N-D	L 0.1	N-D
	PHENANTHRENE	N-D	3.7	N-D	L 0.1	3.6
	PYRENE	N-D	.9	N-D	L 0.1	.8
PESTICIDES	GAMMA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
	PCB-1242	3.2	L 0.1	L 0.1	N-D	N-D
	PCB-1254	.2	N-D	N-D	N-D	N-D
METALS	ANTIMONY	N-D	.9	N-D	L 0.1	.8
	ARSENIC	N-D	5.0	N-D	.2	4.8
	CADMIUM	N-D	4.1	N-D	.2	3.9
	CHROMIUM	7.0	243	.4	11 1	232

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 13

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	PRE-CL SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	COPPER	14.9	389	2.6	16.5	369
	CYANIDE	270	839	61.5	52.0	726
	LEAD	7.3	275	N-D	13.0	262
	MERCURY	L 0.1	.8	N-D	L 0.1	.8
	NICKEL	N-D	55.7	N-D	3.0	52.7
	SELENIUM	N-D	1.3	N-D	L 0.1	1.3
	SILVER	1.2	23.1	N-D	.2	22.9
	THALLIUM	N-D	.1	N-D	L 0.1	.1
	ZINC	29.7	1188	3.3	53.2	1132
NON-CONV. METALS	ALUMINUM	327	-	20.2	NOT RUN	NOT RUN
	BARIUM	16.5	-	5.4	NOT RUN	NOT RUN
	CALCIUM	11194	-	8900	NOT RUN	NOT RUN
	IRON	282	-	12.5	NOT RUN	NOT RUN
	MAGNESIUM	4270	-	3490	NOT RUN	NOT RUN
	MANGANESE	17.5	-	12.7	NOT RUN	NOT RUN
	SODIUM	7881	-	6537	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 13

PARAMETER	INFL-UENT	PRE CL. EFFL	TERT. EFFL	PRIM. SLDG	SEC. SLDG
CHLOROFORM	100 (6)	67 (6)	100 (6)	0 (6)	0 (6)
METHYLENE CHLORIDE	100 (6)	17 (6)	33 (6)	83 (6)	83 (6)
TETRACHLOROETHYLENE	100 (6)	50 (6)	17 (6)	0 (6)	0 (6)
TOLUENE	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	100 (6)	100 (6)	83 (6)	83 (6)
CHROMIUM	100 (6)	50 (6)	0 (6)	100 (6)	100 (6)
COPPER	100 (6)	83 (6)	100 (6)	100 (6)	100 (6)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)
LEAD	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)
SILVER	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)
TRICHLOROETHYLENE	83 (6)	0 (6)	0 (6)	0 (6)	0 (6)
ETHYLBENZENE	67 (6)	0 (6)	0 (6)	83 (6)	0 (6)
DI-N-BUTYL PHTHALATE	67 (6)	100 (6)	100 (6)	50 (6)	33 (6)
PCB-1242	67 (6)	33 (6)	17 (6)	0 (6)	0 (5)
1,1,1-TRICHLOROETHANE	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)
PENTACHLOROPHENOL	33 (6)	17 (6)	33 (6)	0 (6)	0 (6)
PHENOL	33 (6)	17 (6)	50 (6)	83 (6)	83 (6)
PCB-1254	33 (6)	0 (6)	17 (6)	0 (6)	0 (5)
MERCURY	33 (6)	0 (6)	0 (6)	100 (6)	100 (6)
2,4-DINITROPHENOL	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)
BENZENE	0 (6)	0 (6)	0 (6)	100 (6)	83 (6)
1,2-TRANS-DICHLOROETHYLENE	0 (6)	0 (6)	0 (6)	83 (6)	17 (6)
DICHLOROBROMOMETHANE	0 (6)	0 (6)	100 (6)	0 (6)	0 (6)
TRICHLOROFLUOROMETHANE	0 (6)	0 (6)	0 (6)	50 (6)	50 (6)
CHLORODIBROMOMETHANE	0 (6)	0 (6)	67 (6)	0 (6)	0 (6)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	50 (6)	17 (6)
NAPHTHALENE	0 (6)	0 (6)	0 (6)	17 (6)	17 (6)
BUTYL BENZYL PHTHALATE	0 (6)	0 (6)	0 (6)	33 (6)	33 (6)
DIETHYL PHTHALATE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)
11,12-BENZOFLUORANTHENE	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)
CHRYSENE	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)
ANTHRACENE	0 (6)	0 (6)	0 (6)	83 (6)	17 (6)
FLUORENE	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)
PHENANTHRENE	0 (6)	0 (6)	0 (6)	83 (6)	17 (6)
PYRENE	0 (6)	0 (6)	0 (6)	67 (6)	17 (6)
GAMMA-BHC	0 (6)	50 (6)	50 (6)	0 (6)	0 (5)
ANTIMONY	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)
ARSENIC	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)
CADMIUM	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)
NICKEL	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)
SELENIUM	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)
THALLIUM	0 (6)	0 (6)	0 (6)	33 (6)	33 (6)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 14

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	281	13	95	261	10688	2760
	TOTAL SUSP. SOLIDS	MG/L	190	9	95	511	64525	11616
	COD	MG/L	573	61	89	3233	43920	11462
	OIL & GREASE	MG/L	31	9	71	40	1808	397
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	21	7	67	35	304	83
	TOTAL SOLIDS	MG/L	791	502	37	1263	38072	8922
	TOTAL DISS. SOLIDS	MG/L	632	506	20	528	NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	16	L 1	94	28	917	633
	TOTAL VOLATILE SOLIDS	MG/L	323	104	68	577	20283	5249
	VOLATILE DISS. SOLIDS	MG/L	123	68	45	NOT RUN	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	156	6	96	389	37286	9072
	AMMONIA NITROGEN	MG/L	7	5	29	18	86	22
	TOC	MG/L	222	50	77	300	10145	1709
VOLATILES	ACRYLONITRILE	UG/L	L 100	L 100		14	N-D	N-D
	BENZENE	UG/L	9	3	67	3	N-D	0
	CARBON TETRACHLORIDE	UG/L	10	L 5	50	2	N-D	N-D
	CHLOROBENZENE	UG/L	L 5	L 5		1	N-D	N-D
	1,2-DICHLOROETHANE	UG/L	L 5	L 5		11	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	74	1	99	L 5	N-D	N-D
	CHLOROFORM	UG/L	27	12	56	2	N-D	N-D
	1,1-DICHLOROETHYLENE	UG/L	13	L 5	62	L 5	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	5	L 5		L 5	49	N-D
	1,2-DICHLOROPROPANE	UG/L	0	L 5		L 5	N-D	N-D
	ETHYLBENZENE	UG/L	23	L 5	78	1	303	1
	METHYLENE CHLORIDE	UG/L	2058	46	98	10	124	0
	METHYL CHLORIDE	UG/L	7	20		0	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	L 5	L 5		L 5	9	N-D
	TETRACHLOROETHYLENE	UG/L	25	0	100	13	N-D	N-D
	TOLUENE	UG/L	73	1	99	120	26857	1952
	TRICHLOROETHYLENE	UG/L	73	0	100	7	N-D	N-D
ACID EXTRACT	2,4-DICHLOROPHENOL	UG/L	0	L 50		4	N-D	N-D
	PHENOL	UG/L	6	L 60		6	1528	387
BASE-NEUTRALS	BENZIDINE	UG/L	L 20	L 20		L 20	N-D	1
	2,4-DINITROTOLUENE	UG/L	1	L 20		0	N-D	N-D
	FLUORANTHENE	UG/L	L 20	L 20		L 20	14	N-D
	NAPHTHALENE	UG/L	1	L 20		L 20	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	10	83		9	2687	1268

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 14

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	BUTYL BENZYL PHTHALATE	UG/L	1	L 20		L 20	N-D	N-D
	DI-N-BUTYL PHTHALATE	UG/L	10	3	70	3	12	N-D
	DIETHYL PHTHALATE	UG/L	1	L 20		0	N-D	N-D
	ANTHRACENE	UG/L	1	L 20		L 20	34	N-D
	PHENANTHRENE	UG/L	0	L 20		L 20	34	N-D
	PYRENE	UG/L	L 10	L 10		L 10	41	28
PESTICIDES	4,4'-DDT	NG/L	L 1000	L 1000		200	N-D	N-D
METALS	ANTIMONY	UG/L	5	2	60	9	138	80
	ARSENIC	UG/L	4	1	75	27	107	38
	BERYLLIUM	UG/L	L 1	0		1	L 6	L 6
	CADMIUM	UG/L	L 2	L 2		8	297	26
	CHROMIUM	UG/L	155	19	88	1138	32950	3650
	COPPER	UG/L	291	29	90	689	32267	1550
	CYANIDE	UG/L	337	160	53	596	41783	883
	LEAD	UG/L	7	11		416	7250	1817
	MERCURY	NG/L	333	L 1000		2667	33833	21500
	NICKEL	UG/L	394	266	32	546	30583	3750
	SELENIUM	UG/L	6	L 2	67	5	14	7
	SILVER	UG/L	7	0	100	219	243	119
	THALLIUM	UG/L	1	L 1		3	2	L 10
	ZINC	UG/L	799	90	89	2633	149833	20417
NON-CONV. METALS	ALUMINUM	UG/L	1507	213	86	11236	NOT RUN	NOT RUN
	BARIUM	UG/L	112	15	87	643	NOT RUN	NOT RUN
	BORON	UG/L	571	368	36	639	NOT RUN	NOT RUN
	CALCIUM	MG/L	58	54	7	80	NOT RUN	NOT RUN
	COBALT	UG/L	103	124		87	NOT RUN	NOT RUN
	IRON	UG/L	5043	427	92	30683	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	16	15	6	19	NOT RUN	NOT RUN
	MANGANESE	UG/L	231	163	29	674	NOT RUN	NOT RUN
	MOLYBDENUM	UG/L	57	31	46	103	NOT RUN	NOT RUN
	SODIUM	MG/L	91	88	3	70	NOT RUN	NOT RUN
	TIN	UG/L	79	36	54	187	NOT RUN	NOT RUN
	TITANIUM	UG/L	176	22	88	801	NOT RUN	NOT RUN
	VANADIUM	UG/L	9	7	22	25	NOT RUN	NOT RUN
	YTTRIUM	UG/L	4	4		9		

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 14

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	26216	8366	1244	7122	22991
	TOTAL SUSP. SOLIDS	17726	43854	855	42999	96760
	COD	53490	34928	5660	29268	95480
	OIL & GREASE	2892	2014	809	1205	3304
NON-CONVENTIONALS	TOTAL PHENOLS	2.0	.8	.6	.2	.7
	TOTAL SOLIDS	73813	72174	46803	25371	74323
	TOTAL DISS. SOLIDS	58963	-	47177	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	30088	23235	9718	13517	43724
	VOLATILE DISS. SOLIDS	11507	-	6297	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	14539	25407	560	24847	75571
	AMMONIA NITROGEN	684	556	498	57.5	180
	TOC	20681	11457	4696	6761	14236
VOLATILES	BENZENE	.9	.3	.3	N-D	L 0.1
	CARBON TETRACHLORIDE	.9	N-D	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	6.9	L 0.1	L 0.1	N-D	N-D
	CHLOROFORM	2.5	1.1	1.1	N-D	N-D
	1,1-DICHLOROETHYLENE	1.2	N-D	N-D	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	.4	L 0.1	N-D	L 0.1	N-D
	1,2-DICHLOROPROPANE	L 0.1	N-D	N-D	N-D	N-D
	ETHYLBENZENE	2.1	.2	N-D	.2	L 0.1
	METHYLENE CHLORIDE	192	4.4	4.3	L 0.1	L 0.1
	METHYL CHLORIDE	.6	1.9	1.9	N-D	N-D
	TRICHLOROFLUOROMETHANE	N-D	L 0.1	N-D	L 0.1	N-D
	TETRACHLOROETHYLENE	2.3	L 0.1	L 0.1	N-D	N-D
	TOLUENE	6.8	18.0	L 0.1	17.9	16.3
	TRICHLOROETHYLENE	6.8	L 0.1	L 0.1	N-D	N-D
ACID EXTRACT	2,4-DICHLOROPHENOL	L 0.1	N-D	N-D	N-D	N-D
	PHENOL	.5	1.0	N-D	1.0	3.2
BASE-NEUTRALS	2,4-DINITROTOLUENE	L 0.1	N-D	N-D	N-D	N-D
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	NAPHTHALENE	L 0.1	N-D	N-D	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	.9	9.5	7.7	1.8	10.6
	BUTYL BENZYL PHTHALATE	L 0.1	N-D	N-D	N-D	N-D
	DI-N-BUTYL PHTHALATE	.9	.3	.3	L 0.1	N-D
	DIETHYL PHTHALATE	L 0.1	N-D	N-D	N-D	N-D
	ANTHRACENE	L 0.1	L 0.1	N-D	L 0.1	N-D
	PHENANTHRENE	L 0.1	L 0.1	N-D	L 0.1	N-D
	PYRENE	N-D	L 0.1	N-D	L 0.1	.2
METALS	ANTIMONY	.5	.3	.2	L 0.1	.7
	ARSENIC	.4	.2	L 0.1	L 0.1	.3
	BERYLLIUM	N-D	L 0.1	L 0.1	N-D	N-D
	CADMIUM	N-D	.2	N-D	.2	.2
	CHROMIUM	14.5	23.8	1.8	22.0	30.4
	COPPER	27.1	24.2	2.7	21.5	12.9
	CYANIDE	31.4	42.7	14.9	27.8	7.4
	LEAD	.7	5.8	1.0	4.8	15.1

SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 14

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	SECONDARY SLUDGE
METALS	MERCURY	L 0.1	L 0.1	N-D	L 0.1	.2
	NICKEL	36.7	45.2	24.8	20.4	31.2
	SELENIUM	.6	.6	N-D	L 0.1	L 0.1
	SILVER	.7	.2	L 0.1	.2	1.0
	THALLIUM	L 0.1	L 0.1	N-D	L 0.1	N-D
	ZINC	74.5	108	8.4	99.8	170
NON-CONV. METALS	ALUMINUM	141	-	19.9	NOT RUN	NOT RUN
	BARIUM	10.5	-	1.4	NOT RUN	NOT RUN
	BORON	53.3	-	34.3	NOT RUN	NOT RUN
	CALCIUM	5411	-	5069	NOT RUN	NOT RUN
	COBALT	9.6	-	11.5	NOT RUN	NOT RUN
	IRON	471	-	39.9	NOT RUN	NOT RUN
	MAGNESIUM	1462	-	1368	NOT RUN	NOT RUN
	MANGANESE	21.5	-	15.2	NOT RUN	NOT RUN
	MOLYBDENUM	5.3	-	2.9	NOT RUN	NOT RUN
	SODIUM	8505	-	8163	NOT RUN	NOT RUN
	TIN	7.3	-	3.4	NOT RUN	NOT RUN
	TITANIUM	16.4	-	2.1	NOT RUN	NOT RUN
	VANADIUM	.8	-	.7	NOT RUN	NOT RUN
	YTTRIUM	.4	-	.3	NOT RUN	NOT RUN

SECONDARY SLUDGE IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 14

PARAMETER	INFL-UENT	OTHER INFL.	SEC. EFFL.	COMB. SLDG	SEC. SLDG	TAP WATER
1,1,1-TRICHLOROETHANE	100 (6)	0 (6)	17 (6)	0 (6)	0 (6)	0 (1)
CHLOROFORM	100 (6)	67 (6)	100 (6)	0 (6)	0 (6)	100 (1)
1,2-TRANS-DICHLOROETHYLENE	100 (6)	0 (6)	0 (6)	50 (6)	0 (6)	0 (1)
TETRACHLOROETHYLENE	100 (6)	100 (6)	33 (6)	0 (6)	0 (6)	0 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	80 (5)	100 (5)	100 (6)	100 (6)	100 (1)
ANTIMONY	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
ARSENIC	100 (6)	100 (6)	33 (6)	100 (6)	100 (6)	0 (1)
CHROMIUM	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
COPPER	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
NICKEL	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
SILVER	100 (6)	100 (6)	33 (6)	100 (6)	100 (6)	0 (1)
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
METHYLENE CHLORIDE	83 (6)	67 (6)	67 (6)	17 (6)	17 (6)	0 (1)
TOLUENE	83 (6)	100 (6)	50 (6)	100 (6)	100 (6)	100 (1)
PHENOL	83 (6)	100 (6)	0 (5)	100 (6)	67 (6)	0 (1)
ETHYLBENZENE	67 (6)	50 (6)	0 (6)	100 (6)	33 (6)	0 (1)
TRICHLOROETHYLENE	67 (6)	33 (6)	33 (6)	0 (6)	0 (6)	0 (1)
DI-N-BUTYL PHTHALATE	67 (6)	80 (5)	40 (5)	17 (6)	0 (6)	100 (1)
BENZENE	50 (6)	50 (6)	83 (6)	0 (6)	17 (6)	100 (1)
1,1-DICHLOROETHYLENE	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
DIETHYL PHTHALATE	33 (6)	20 (5)	0 (5)	0 (6)	0 (6)	0 (1)
CARBON TETRACHLORIDE	17 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-DICHLOROPROPANE	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
METHYL CHLORIDE	17 (6)	17 (6)	17 (6)	0 (6)	0 (6)	0 (1)
2,4-DICHLOROPHENOL	17 (6)	17 (6)	0 (5)	0 (6)	0 (6)	0 (1)
2,4-DINITROTOLUENE	17 (6)	20 (5)	0 (5)	0 (6)	0 (6)	0 (1)
NAPHTHALENE	17 (6)	0 (5)	0 (5)	0 (6)	0 (6)	0 (1)
BUTYL BENZYL PHTHALATE	17 (6)	0 (5)	0 (5)	0 (6)	0 (6)	0 (1)
ANTHRACENE	17 (6)	0 (5)	0 (5)	17 (6)	0 (6)	0 (1)
PHENANTHRENE	17 (6)	0 (5)	0 (5)	17 (6)	0 (6)	0 (1)
LEAD	17 (6)	100 (6)	17 (6)	100 (6)	100 (6)	0 (1)
MERCURY	17 (6)	100 (6)	0 (6)	100 (6)	100 (6)	0 (1)
SELENIUM	17 (6)	17 (6)	0 (6)	100 (6)	83 (6)	100 (1)
THALLIUM	17 (6)	17 (6)	0 (6)	17 (6)	0 (6)	0 (1)
ACRYLONITRILE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
CHLOROBENZENE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-DICHLOROETHANE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
DICHLOROBROMOMETHANE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	100 (1)
TRICHLOROFLUOROMETHANE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (1)
FLUORANTHENE	0 (6)	0 (5)	0 (5)	17 (6)	0 (6)	0 (1)
PYRENE	0 (6)	0 (5)	0 (5)	33 (6)	17 (6)	0 (1)
4,4'-DDT	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
BERYLLIUM	0 (6)	67 (6)	17 (6)	0 (6)	0 (6)	0 (1)
CADMIUM	0 (6)	83 (6)	0 (6)	100 (6)	100 (6)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 15

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	COMBINED SLUDGE
CONVENTIONALS	BOD	MG/L	115	13	89	93	25346
	TOTAL SUSP. SOLIDS	MG/L	131	19	85	160	118929
	COD	MG/L	252	86	66	331	90400
	OIL & GREASE	MG/L	36	5	86	34	4763
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	33	32	3	96	295
	TOTAL SOLIDS	MG/L	455	366	20	511	56374
	TOTAL DISS. SOLIDS	MG/L	228	291		345	NOT RUN
	SETTLEABLE SOLIDS	ML/L	7	L 1	86	9	1600
	TOTAL VOLATILE SOLIDS	MG/L	152	127	16	209	37578
	VOLATILE DISS. SOLIDS	MG/L	69	27	61	191	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	90	11	36	116	70179
	AMMONIA NITROGEN	MG/L	11	8	27	12	41
	TOC	MG/L	164	74	55	183	8668
VOLATILES	BENZENE	UG/L	2	L 1	50	L 1	8
	1,2-DICHLOROETHANE	UG/L	0	L 1		L 1	N-D
	1,1,1-TRICHLOROETHANE	UG/L	100	3	97	4	N-D
	1,1-DICHLOROETHANE	UG/L	1	L 1		L 1	44
	CHLOROFORM	UG/L	8	2	75	7	N-D
	1,1-DICHLOROETHYLENE	UG/L	0	L 1		L 1	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	1	L 1		1	42
	1,2-DICHLOROPROPANE	UG/L	0	L 1		L 1	N-D
	ETHYLBENZENE	UG/L	2	L 1	50	1	59
	METHYLENE CHLORIDE	UG/L	6	3	50	16	24
	TRICHLOROFLUOROMETHANE	UG/L	L 1	L 1		2	N-D
	TETRACHLOROETHYLENE	UG/L	11	2	82	2	127
	TOLUENE	UG/L	4	1	75	L 1	927
	TRICHLOROETHYLENE	UG/L	3	L 1	67	2	93
ACID EXTRACT	PENTACHLOROPHENOL	UG/L	5	L 5		1	N-D
	PHENOL	UG/L	3	0	100	1	N-D
BASE-NEUTRALS	HEXACHLOROBENZENE	UG/L	L 9	L 9		L 9	38
	FLUORANTHENE	UG/L	L 3	L 3		L 3	66
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	14	8	43	15	5225
	BUTYL BENZYL PHTHALATE	UG/L	2	L 2		2	1025
	DI-N-BUTYL PHTHALATE	UG/L	5	2	60	5	205
	DIETHYL PHTHALATE	UG/L	4	0	100	6	N-D
	11,12-BENZOFLUORANTHENE	UG/L	L 10	L 10		L 10	13
	ANTHRACENE	UG/L	L 3	L 3		L 3	68

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 15

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	COMBINED SLUDGE
BASE-NEUTRALS	PHENANTHRENE	UG/L	L 3	L 3		L 3	68
	PYRENE	UG/L	L 3	L 3		L 3	287
PESTICIDES	DIELDRIN	NG/L	7	L 150		L 300	N-D
	HEPTACHLOR	NG/L	L 200	5		28	N-D
	GAMMA-BHC	NG/L	27	43		67	N-D
	PCB-1242	NG/L	4133	817	80	9708	N-D
	PCB-1254	NG/L	L 3600	83		75	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	207
	ARSENIC	UG/L	L 50	L 50		L 50	1048
	BERYLLIUM	UG/L	L 2	L 2		L 2	6
	CADMIUM	UG/L	1	L 2		L 2	500
	CHROMIUM	UG/L	9	L 5	44	23	10400
	COPPER	UG/L	58	25	57	64	31000
	CYANIDE	UG/L	125	876		147	65200
	LEAD	UG/L	9	L 20		15	14925
	MERCURY	NG/L	483	L 200	59	417	139000
	NICKEL	UG/L	96	13	86	2	3817
	SELENIUM	UG/L	L 50	L 50		L 50	303
	SILVER	UG/L	11	2	82	11	89
	ZINC	UG/L	145	36	75	343	126500
NON-CONV. METALS	ALUMINUM	UG/L	569	111	80	615	NOT RUN
	BARIUM	UG/L	104	32	69	50	NOT RUN
	CALCIUM	MG/L	47	49		45	NOT RUN
	IRON	UG/L	732	252	66	619	NOT RUN
	MAGNESIUM	MG/L	6	7		7	NOT RUN
	MANGANESE	UG/L	87	60	31	90	NOT RUN
	SODIUM	MG/L	39	37	5	46	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 15

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	OTHER INFLUENT
CONVENTIONALS	BOD	6303	3524	566	2958	2553
	TOTAL SUSP. SOLIDS	7199	16234	1462	14772	4371
	COD	13812	15400	5262	10138	9062
	OIL & GREASE	1946	732	201	531	927
NON-CONVENTIONALS	TOTAL PHENOLS	1.8	2.6	2.6	L 0.1	2.6
	TOTAL SOLIDS	24930	26788	19787	7001	14009
	TOTAL DISS. SOLIDS	12508	-	15822	NOT RUN	9444
	TOTAL VOLATILE SOLIDS	8340	11143	6815	4328	5723
	VOLATILE DISS. SOLIDS	3782	-	1297	NOT RUN	5221
	TOTAL VOL. SUS. SOLIDS	4951	9392	840	8552	3174
	AMMONIA NITROGEN	576	407	402	4.5	315
	TOC	8980	4475	3490	985	5011
VOLATILES	BENZENE	.1	L 0.1	N-D	L 0.1	N-D
	1,2-DICHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	5.5	.1	.1	N-D	.1
	1,1-DICHLOROETHANE	L 0.1	L 0.1	N-D	L 0.1	N-D
	CHLOROFORM	.4	L 0.1	L 0.1	N-D	.2
	1,1-DICHLOROETHYLENE	L 0.1	N-D	N-D	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	1,2-DICHLOROPROPANE	L 0.1	N-D	N-D	N-D	N-D
	ETHYLBENZENE	.1	L 0.1	N-D	L 0.1	L 0.1
	METHYLENE CHLORIDE	.3	.1	.1	L 0.1	.5
	TRICHLOROFLUOROMETHANE	N-D	N-D	N-D	N-D	L 0.1
	TETRACHLOROETHYLENE	.6	.1	.1	L 0.1	L 0.1
	TOLUENE	.2	.1	L 0.1	.1	N-D
	TRICHLOROETHYLENE	.1	L 0.1	N-D	L 0.1	L 0.1
ACID EXTRACT	PENTACHLOROPHENOL	.3	N-D	N-D	N-D	L 0.1
	PHENOL	.1	N-D	N-D	N-D	L 0.1
BASE-NEUTRALS	HEXACHLOROBENZENE	N-D	L 0.1	N-D	L 0.1	N-D
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	.8	1.1	.5	.6	.4
	BUTYL BENZYL PHTHALATE	.1	L 0.1	N-D	L 0.1	L 0.1
	DI-N-BUTYL PHTHALATE	.3	.1	L 0.1	L 0.1	.1
	DIETHYL PHTHALATE	.2	L 0.1	L 0.1	N-D	.2
	11,12-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	ANTHRACENE	N-D	L 0.1	N-D	L 0.1	N-D
	PHENANTHRENE	N-D	L 0.1	N-D	L 0.1	N-D
	PYRENE	N-D	L 0.1	N-D	L 0.1	N-D
PESTICIDES	DIELDRIN	L 0.1	N-D	N-D	N-D	N-D
	HEPTACHLOR	N-D	L 0.1	L 0.1	N-D	L 0.1
	GAMMA-BHC	L 0.1	L 0.1	L 0.1	N-D	L 0.1
	PCB-1242	.2	L 0.1	L 0.1	N-D	.3
	PCB-1254	N-D	L 0.1	L 0.1	N-D	L 0.1
METALS	ANTIMONY	N-D	L 0.1	N-D	L 0.1	N-D
	ARSENIC	N-D	.1	N-D	.1	N-D

OTHER INFLUENT IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 15

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	COMBINED SLUDGE	OTHER INFLUENT
METALS	BERYLLIUM	N-D	L 0.1	N-D	L 0.1	N-D
	CADMIUM	L 0.1	L 0.1	N-D	L 0.1	N-D
	CHROMIUM	.5	1.5	N-D	1.5	.6
	COPPER	3.2	5.5	1.3	4.2	1.7
	CYANIDE	6.8	33.4	25.8	7.6	4.0
	LEAD	.5	1.7	N-D	1.7	.4
	MERCURY	L 0.1	L 0.1	N-D	L 0.1	L 0.1
	NICKEL	5.2	1.4	.8	.6	L 0.1
	SELENIUM	N-D	L 0.1	N-D	L 0.1	N-D
	SILVER	.6	L 0.1	N-D	L 0.1	.3
	ZINC	7.9	17.2	2.0	15.2	9.4
NON-CONV. METALS	ALUMINUM	31.2	-	6.6	NOT RUN	16.8
	BARIUM	5.7	-	1.8	NOT RUN	1.4
	CALCIUM	2549	-	2814	NOT RUN	1238
	IRON	40.1	-	12.7	NOT RUN	17.0
	MAGNESIUM	347	-	384	NOT RUN	192
	MANGANESE	4.8	-	2.6	NOT RUN	2.5
	SODIUM	2138	-	1973	NOT RUN	1265

OTHER INFLUENT IS NOT INCLUDED IN TOTAL OUT COLUMN
POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED
vp

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 15

PARAMETER	INFL-UENT	OTHER INFL.	SEC. EFFL	COMB. SLDG	TAP WATER
BENZENE	100 (6)	0 (6)	0 (6)	100 (4)	0 (1)
1,1,1-TRICHLOROETHANE	100 (6)	100 (6)	67 (6)	0 (4)	0 (1)
CHLOROFORM	100 (6)	100 (6)	83 (6)	0 (4)	100 (1)
METHYLENE CHLORIDE	100 (6)	83 (6)	100 (6)	100 (4)	0 (1)
TETRACHLOROETHYLENE	100 (6)	100 (6)	100 (6)	50 (4)	0 (1)
TOLUENE	100 (6)	0 (6)	50 (6)	100 (4)	0 (1)
TRICHLOROETHYLENE	100 (6)	100 (6)	0 (6)	100 (4)	0 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	100 (6)	100 (6)	100 (4)	0 (1)
DI-N-BUTYL PHTHALATE	100 (6)	100 (6)	83 (6)	100 (4)	0 (1)
DIETHYL PHTHALATE	100 (6)	100 (6)	17 (6)	0 (4)	0 (1)
COPPER	100 (6)	100 (6)	100 (6)	100 (3)	0 (1)
CYANIDE	100 (5)	100 (5)	100 (5)	100 (2)	0 ( )
SILVER	100 (6)	67 (6)	33 (6)	100 (3)	0 (1)
ZINC	100 (6)	100 (6)	100 (6)	100 (4)	100 (1)
BUTYL BENZYL PHTHALATE	83 (6)	83 (6)	0 (6)	100 (4)	0 (1)
CHROMIUM	83 (6)	100 (6)	0 (6)	100 (3)	0 (1)
MERCURY	83 (6)	100 (6)	0 (6)	100 (4)	0 (1)
NICKEL	83 (6)	17 (6)	83 (6)	100 (3)	0 (1)
ETHYLBENZENE	67 (6)	50 (6)	0 (6)	100 (4)	0 (1)
PENTACHLOROPHENOL	67 (6)	17 (6)	0 (6)	0 (4)	0 (1)
PHENOL	67 (6)	50 (6)	17 (6)	0 (4)	0 (1)
PCB-1242	67 (6)	83 (6)	33 (6)	0 (4)	0 (1)
1,2-TRANS-DICHLOROETHYLENE	50 (6)	33 (6)	0 (6)	75 (4)	0 (1)
1,1-DICHLOROETHANE	33 (6)	0 (6)	0 (6)	75 (4)	0 (1)
LEAD	33 (6)	33 (6)	0 (6)	100 (4)	0 (1)
1,2-DICHLOROETHANE	17 (6)	0 (6)	0 (6)	0 (4)	0 (1)
1,1-DICHLOROETHYLENE	17 (6)	0 (6)	0 (6)	0 (4)	0 (1)
1,2-DICHLOROPROPANE	17 (6)	0 (6)	0 (6)	0 (4)	0 (1)
DIELDRIN	17 (6)	0 (6)	0 (6)	0 (4)	0 (1)
GAMMA-BHC	17 (6)	17 (6)	33 (6)	0 (4)	0 (1)
CADMIUM	17 (6)	0 (6)	0 (6)	100 (3)	0 (1)
DICHLOROBROMOMETHANE	0 (6)	0 (6)	0 (6)	0 (4)	100 (1)
TRICHLOROFLUOROMETHANE	0 (6)	50 (6)	0 (6)	0 (4)	0 (1)
HEXACHLOROBENZENE	0 (6)	0 (6)	0 (6)	25 (4)	0 (1)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	75 (4)	0 (1)
11,12-BENZOFLUORANTHENE	0 (6)	0 (6)	0 (6)	25 (4)	0 (1)
ANTHRACENE	0 (6)	0 (6)	0 (6)	50 (4)	0 (1)
PHENANTHRENE	0 (6)	0 (6)	0 (6)	50 (4)	0 (1)
PYRENE	0 (6)	0 (6)	0 (6)	75 (4)	0 (1)
HEPTACHLOR	0 (6)	17 (6)	17 (6)	0 (4)	0 (1)
PCB-1254	0 (6)	17 (6)	17 (6)	0 (4)	0 (1)
ANTIMONY	0 (6)	0 (6)	0 (6)	100 (4)	0 (1)
ARSENIC	0 (6)	0 (6)	0 (6)	100 (4)	0 (1)
BERYLLIUM	0 (6)	0 (6)	0 (6)	25 (4)	0 (1)
SELENIUM	0 (6)	0 (6)	0 (6)	100 (4)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 16

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	TERTIARY EFFLUENT	COMB. SLUDGE	COMB. SLUDGE -2
CONV.	BOD	MG/L	214	11	95	282	11	15881	21041
	TOTAL SUSP. SOLIDS	MG/L	217	16	93	198	4	54674	62112
	COD	MG/L	553	121	78	667	63	50400	84800
	OIL $ GREASE	MG/L	41	6	85	34	12	3600	4933
NON-CONV.	TOTAL PHENOLS	UG/L	36	15	58	40	11	146	393
	TOTAL SOLIDS	MG/L	736	470	36	716	424	31591	44287
	TOTAL DISS. SOLIDS	MG/L	481	450	6	531	445	NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	12	L 1	92	8	L 1	983	997
	TOTAL VOLATILE SOLIDS	MG/L	286	63	78	315	109	24479	34381
	VOLATILE DISS. SOLIDS	MG/L	47	48		77	50	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	164	10	94	152	3	43583	51167
	AMMONIA NITROGEN	MG/L	17	9	47	12	9	120	63
	TOC	MG/L	84	21	75	144	19	2771	3833
VOLATILES	BENZENE	UG/L	1	L 1		1	L 1	4	14
	CARBON TETRACHLORIDE	UG/L	2	28		377	1	N-D	N-D
	CHLOROBENZENE	UG/L	L 1	0		L 1	0	3	7
	1,2-DICHLOROETHANE	UG/L	0	L 1		0	L 1	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	21	0	100	52	1	N-D	N-D
	1,1-DICHLOROETHANE	UG/L	0	L 1		3	L 1	35	598
	1,1,2-TRICHLOROETHANE	UG/L	0	L 1		L 1	0	N-D	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 10	0		L 10	0	N-D	N-D
	CHLOROFORM	UG/L	39	30	23	41	7	1	4
	1,1-DICHLOROETHYLENE	UG/L	L 1	L 1		0	L 1	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	1	L 1		9	L 1	305	733
	1,2-DICHLOROPROPANE	UG/L	L 1	L 1		L 1	L 1	1	4
	ETHYLBENZENE	UG/L	6	1	83	51	0	77	412
	METHYLENE CHLORIDE	UG/L	38	5	87	92	5	77	111
	METHYL BROMIDE	UG/L	L 20	L 20		7	L 20	N-D	N-D
	DICHLOROBROMOMETHANE	UG/L	0	0		0	L 1	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	L 1	L 1		5	L 1	N-D	N-D
	TETRACHLOROETHYLENE	UG/L	46	2	96	138	1	12	241
	TOLUENE	UG/L	33	1	97	131	0	117	418
	TRICHLOROETHYLENE	UG/L	13	2	85	171	1	240	1927
	VINYL CHLORIDE	UG/L	L 20	L 20		11	L 20	N-D	N-D
ACIDS.	2,4,6-TRICHLOROPHENOL	UG/L	L 2	L 2		2	L 2	N-D	N-D
	2,4-DICHLOROPHENOL	UG/L	1	L 2		1	L 2	N-D	N-D
	2,4-DIMETHYLPHENOL	UG/L	L 2	0		9	L 2	N-D	N-D
	PENTACHLOROPHENOL	UG/L	3	1	67	17	4	N-D	N-D
	PHENOL	UG/L	32	1	97	103	L 1	N-D	92
BASE-NEUT.	1,2-DICHLOROBENZENE	UG/L	18	2	89	80	2	N-D	N-D
	1,3-DICHLOROBENZENE	UG/L	L 3	L 3		17	L 3	150	N-D
	1,4-DICHLOROBENZENE	UG/L	3	L 3		37	L 3	1217	3727
	FLUORANTHENE	UG/L	L 3	L 3		L 3	L 3	48	203
	NAPHTHALENE	UG/L	1	L 2		47	L 2	238	3100
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	28	7	75	46	4	2317	3150
	BUTYL BENZYL PHTHALATE	UG/L	4	L 2	50	5	L 2	355	577

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 16

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER INFLUENT	TERTIARY EFFLUENT	COMB. SLUDGE	COMB. SLUDGE -2
BASE-NEUT	DI-N-BUTYL PHTHALATE	UG/L	3	2	33	11	0	163	775
	DIETHYL PHTHALATE	UG/L	6	1	83	6	L 3	N-D	N-D
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		L 5	L 5	15	05
	BENZO (A)PYRENE	UG/L	L 20	L 20		L 20	L 20	N-D	82
	CHRYSENE	UG/L	L 5	L 5		L 5	L 5	15	85
	ANTHRACENE	UG/L	L 3	L 3		L 3	L 3	161	283
	PHENANTHRENE	UG/L	L 3	L 3		L 3	L 3	161	283
	PYRENE	UG/L	L 3	L 30		L 3	L 3	49	89
PESTICIDES	4,4'-DDD	NG/L	L 600	L 600		L 600	38	N-D	N-D
	ALPHA-BHC	NG/L	105	292		28	73	N-D	N-D
	GAMMA-BHC	NG/L	98	245		L 100	145	N-D	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	L 50	338	240
	ARSENIC	UG/L	26	12	54	L 50	L 50	868	218
	BERYLLIUM	UG/L	L 2	L 2		L 2	L 2	10	10
	CADMIUM	UG/L	5	2	60	28	L 2	560	2627
	CHROMIUM	UG/L	61	35	43	247	20	4900	19883
	COPPER	UG/L	131	26	80	184	5	10850	22533
	CYANIDE	UG/L	284	447		307	143	20455	36417
	LEAD	UG/L	114	20	82	217	6	26350	27490
	MERCURY	NG/L	583	183	69	1683	200	35167	75667
	NICKEL	UG/L	76	57	25	93	54	2705	5307
	SELENIUM	UG/L	L 50	L 50		L 50	L 50	144	28162
	SILVER	UG/L	7	5	29	69	L 2	147	1373
	ZINC	UG/L	214	56	74	344	31	19500	43667
N-C METALS	ALUMINUM	UG/L	1372	210	85	808	16	NOT RUN	NOT RUN
	BARIUM	UG/L	167	23	86	118	11	NOT RUN	NOT RUN
	CALCIUM	MG/L	33	31	6	37	30	NOT RUN	NOT RUN
	IRON	UG/L	1290	312	76	1665	110	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	4	4		5	4	NOT RUN	NOT RUN
	MANGANESE	UG/L	49	34	31	57	32	NOT RUN	NOT RUN
	SODIUM	MG/L	88	82	7	71	82	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 16

PARAMETER	INFLUENT 1	INFLUENT 2	TOTAL IN	TOTAL OUT	TERTIARY EFFLUENT	COMBINED SLUDGE	COMBINED SLUDGE 2
BOD	203243	73187	276430	64770	13284	25164	26322
TOTAL SUSP. SOLIDS	205456	51226	256682	169371	5032	86637	77702
COD	524703	172916	697619	262432	76483	79864	106085
OIL & GREASE	38562	8689	47251	25966	14089	5705	6172
TOTAL PHENOLS	34.0	10.4	44.4	13.7	13.0	.2	.5
TOTAL SOLIDS	698234	185712	883946	617095	511633	50059	[illegible]403
TOTAL DISS. SOLIDS	456428	137814	594242	-	537396	NOT RUN	NOT RUN
TOTAL VOLATILE SOLIDS	270728	81703	352431	213834	132034	38789	43011
VOLATILE DISS. SOLIDS	44726	19929	64655	-	60583	NOT RUN	NOT RUN
TOTAL VOL. SUS. SOLIDS	155040	39511	194551	136493	3422	69062	64009
AMMONIA NITROGEN	16120	3156	19276	10935	10667	190	78.4
TOC	79338	37307	116645	31728	22542	4391	4795
BENZENE	.9	.3	1.2	L 0.1	N-D	L 0.1	L 0.1
CARBON TETRACHLORIDE	1.4	97.7	99.1	.8	.8	N-D	N-D
CHLOROBENZENE	N-D	N-D	N-D	.2	.2	L 0.1	L 0.1
1,2-DICHLOROETHANE	.2	L 0.1	.2	N-D	N-D	N-D	N-D
1,1,1-TRICHLOROETHANE	19.6	13.4	33.0	.6	.6	N-D	N-D
1,1-DICHLOROETHANE	.2	.6	.8	.8	N-D	L 0.1	.7
1,1,2-TRICHLOROETHANE	.3	N-D	.3	.2	.2	N-D	N-D
1,1,2,2-TETRACHLOROETHANE	N-D	N-D	N-D	.4	.4	N-D	N-D
CHLOROFORM	36.8	10.6	47.4	8.1	8.1	L 0.1	L 0.1
1,1-DICHLOROETHYLENE	N-D	L 0.1	L 0.1	N-D	N-D	N-D	N-D
1,2-TRANS-DICHLOROETHYLENE	.9	2.2	3.1	1.4	N-D	.5	.9
1,2-DICHLOROPROPANE	N-D	N-D	N-D	L 0.1	N-D	L 0.1	L 0.1
ETHYLBENZENE	5.8	13.1	18.9	1.0	.4	.1	.5
METHYLENE CHLORIDE	36.3	23.9	60.2	6.0	5.8	.1	.1
METHYL BROMIDE	N-D	1.7	1.7	N-D	N-D	N-D	N-D
DICHLOROBROMOMETHANE	.2	L 0.1	.2	N-D	N-D	N-D	N-D
TRICHLOROFLUOROMETHANE	N-D	1.2	1.2	N-D	N-D	N-D	N-D
TETRACHLOROETHYLENE	43.6	35.8	79.4	1.5	1.2	L 0.1	.3
TOLUENE	31.3	33.9	65.2	1.1	.4	.2	.5
TRICHLOROETHYLENE	12.3	44.3	56.6	3.4	.6	.4	2.4
VINYL CHLORIDE	N-D	2.9	2.9	N-D	N-D	N-D	N-D
2,4,6-TRICHLOROPHENOL	N-D	.5	.5	N-D	N-D	N-D	N-D
2,4-DICHLOROPHENOL	.8	.3	1.1	N-D	N-D	N-D	N-D
2,4-DIMETHYLPHENOL	N-D	2.4	2.4	N-D	N-D	N-D	N-D
PENTACHLOROPHENOL	2.8	4.4	7.2	4.8	4.8	N-D	N-D
PHENOL	29.9	26.6	56.5	.1	N-D	N-D	N-D
1,2-DICHLOROBENZENE	16.8	20.6	37.4	1.8	1.8	N-D	N-D
1,3-DICHLOROBENZENE	N-D	4.3	4.3	.2	N-D	.2	L 0.1
1,4-DICHLOROBENZENE	2.5	9.6	12.1	6.6	N-D	1.9	4.7
FLUORANTHENE	N-D	N-D	N-D	.4	N-D	L 0.1	.3
NAPHTHALENE	.8	12.1	12.9	4.3	N-D	.4	3.9
BIS(2-ETHYLHEXYL) PHTHALATE	26.1	11.9	38.0	11.8	4.2	3.7	3.9
BUTYL BENZYL PHTHALATE	3.3	1.2	4.5	1.3	N-D	.6	.7
DI-N-BUTYL PHTHALATE	2.5	2.9	5.4	1.7	.4	.3	1.0
DIETHYL PHTHALATE	5.8	1.5	7.3	N-D	N-D	N-D	N-D

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 16

PARAMETER	INFLUENT 1	INFLUENT 2	TOTAL IN	TOTAL OUT	TERTIARY EFFLUENT	COMBINED SLUDGE	COMBINED SLUDGE 2
1,2-BENZANTHRACENE	N-D	N-D	N-D	.1	N-D	L 0.1	.1
BENZO (A)PYRENE	N-D	N-D	N-D	.1	N-D	N-D	N-D
CHRYSENE	N-D	N-D	N-D	.1	N-D	L 0.1	.1
ANTHRACENE	N-D	N-D	N-D	.7	N-D	.3	.4
PHENANTHRENE	N-D	N-D	N-D	.7	N-D	.3	.4
PYRENE	N-D	N-D	N-D	.2	N-D	L 0.1	.1
4,4'-DDD	N-D	N-D	N-D	L 0.1	L 0.1	N-D	N-D
ALPHA-BHC	L 0.1	L 0.1	.1	L 0.1	L 0.1	N-D	N-D
GAMMA-BHC	L 0.1	N-D	L 0.1	.2	.2	N-D	N-D
ANTIMONY	N-D	N-D	N-D	.8	N-D	.5	.3
ARSENIC	24.8	N-D	24.8	1.7	N-D	1.4	.3
BERYLLIUM	N-D	N-D	N-D	L 0.1	N-D	L 0.1	L 0.1
CADMIUM	4.6	7.3	11.9	4.2	N-D	.9	3.3
CHROMIUM	57.8	64.2	122	56.5	23.8	7.8	24.9
COPPER	124	47.6	172	51.4	6.0	17.2	28.2
CYANIDE	269	79.6	349	250	172	32.4	45.6
LEAD	108	56.2	164	83.0	6.8	41.8	34.4
MERCURY	.6	.4	1.0	.4	.2	L 0.1	L 0.1
NICKEL	72.4	24.0	96.4	76.5	65.6	4.3	6.6
SELENIUM	N-D	N-D	N-D	35.4	N-D	.2	35.2
SILVER	6.8	17.8	24.6	1.9	N-D	.2	1.7
ZINC	203	89.2	292	123	37.2	30.9	54.6
ALUMINUM	1301	210	1511	-	18.9	NOT RUN	NOT RUN
BARIUM	158	30.6	189	-	12.9	NOT RUN	NOT RUN
CALCIUM	30818	9640	40458	-	35625	NOT RUN	NOT RUN
IRON	1223	432	1655	-	132	NOT RUN	NOT RUN
MAGNESIUM	3951	1297	5248	-	4831	NOT RUN	NOT RUN
MANGANESE	46.8	14.7	61.5	-	38.2	NOT RUN	NOT RUN
SODIUM	83131	18416	101547	-	98623	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 16

PARAMETER	INFL-UENT	OTHER INFL.	SEC. EFFL	TERT. EFFL.	COMB. SLDG	COMB. SLDG-2	TAP WATER
1,1,1-TRICHLOROETHANE	100 (6)	67 (6)	17 (6)	33 (6)	0 (6)	0 (6)	0 (1)
CHLOROFORM	100 (6)	100 (6)	100 (6)	50 (6)	17 (6)	50 (6)	100 (1)
METHYLENE CHLORIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
TETRACHLOROETHYLENE	100 (6)	100 (6)	100 (6)	50 (6)	50 (6)	100 (6)	0 (1)
TOLUENE	100 (6)	83 (6)	83 (6)	33 (6)	83 (6)	100 (6)	0 (1)
TRICHLOROETHYLENE	100 (6)	100 (6)	67 (6)	33 (6)	100 (6)	100 (6)	0 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	100 (6)	100 (6)	100 (6)	50 (6)	100 (6)	100 (6)	0 ( )
DIETHYL PHTHALATE	100 (6)	100 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 ( )
CADMIUM	100 (6)	100 (6)	50 (6)	0 (6)	100 (6)	100 (6)	0 ( )
CHROMIUM	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
COPPER	100 (6)	100 (6)	100 (6)	83 (6)	100 (6)	100 (6)	0 ( )
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
LEAD	100 (6)	100 (6)	50 (6)	17 (6)	100 (6)	100 (6)	0 ( )
MERCURY	100 (6)	100 (6)	83 (6)	100 (6)	67 (6)	67 (6)	0 ( )
NICKEL	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
SILVER	100 (6)	100 (6)	100 (6)	0 (6)	100 (6)	100 (6)	0 ( )
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
BENZENE	83 (6)	67 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
ETHYLBENZENE	83 (6)	100 (6)	33 (6)	33 (6)	100 (6)	100 (6)	0 (1)
1,2-TRANS-DICHLOROETHYLENE	67 (6)	67 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
PHENOL	67 (6)	100 (6)	17 (6)	0 (6)	0 (6)	50 (6)	0 ( )
1,2-DICHLOROBENZENE	67 (6)	100 (6)	33 (6)	17 (6)	0 (6)	0 (6)	0 ( )
BUTYL BENZYL PHTHALATE	67 (6)	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 ( )
DI-N-BUTYL PHTHALATE	50 (6)	83 (6)	83 (6)	17 (6)	100 (6)	100 (6)	0 ( )
CARBON TETRACHLORIDE	33 (6)	67 (6)	100 (6)	17 (6)	0 (6)	0 (6)	0 (1)
NAPHTHALENE	33 (6)	100 (6)	0 (6)	0 (6)	83 (6)	100 (6)	0 ( )
GAMMA-BHC	33 (6)	0 (6)	50 (6)	50 (6)	0 (6)	0 (6)	0 ( )
ARSENIC	33 (6)	0 (6)	17 (6)	0 (6)	100 (6)	100 (6)	0 ( )
1,2-DICHLOROETHANE	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,1-DICHLOROETHANE	17 (6)	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
1,1,2-TRICHLOROETHANE	17 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (6)	0 (1)
DICHLOROBROMOMETHANE	17 (6)	17 (6)	33 (6)	0 (6)	0 (6)	0 (6)	100 (1)
2,4-DICHLOROPHENOL	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 ( )
PENTACHLOROPHENOL	17 (6)	67 (6)	17 (6)	33 (6)	0 (6)	0 (6)	0 ( )
1,4-DICHLOROBENZENE	17 (6)	67 (6)	0 (6)	0 (6)	17 (6)	50 (6)	0 ( )
ALPHA-BHC	17 (6)	17 (6)	83 (6)	50 (6)	0 (6)	0 (6)	0 ( )
CHLOROBENZENE	0 (6)	0 (6)	17 (6)	17 (6)	67 (6)	50 (6)	0 (1)
1,1,2,2-TETRACHLOROETHANE	0 (6)	0 (6)	17 (6)	17 (6)	0 (6)	0 (6)	0 (1)
1,1-DICHLOROETHYLENE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-DICHLOROPROPANE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	33 (6)	0 (1)
METHYL BROMIDE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
TRICHLOROFLUOROMETHANE	0 (6)	67 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
CHLORODIBROMOMETHANE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	100 (1)
VINYL CHLORIDE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
2,4,6-TRICHLOROPHENOL	0 (6)	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 ( )
2,4-DIMETHYLPHENOL	0 (6)	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 ( )
1,3-DICHLOROBENZENE	0 (6)	50 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 ( )
FLUORANTHENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)	100 (6)	0 ( )
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	83 (6)	0 ( )
BENZO (A)PYRENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 ( )
CHRYSENE	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	83 (6)	0 ( )

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 16

PARAMETER	INFL-UENT	OTHER INFL.	SEC. EFFL	TERT. EFFL.	COMB. SLDG	COMB. SLDG-2	TAP WATER
ANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 ( )
PHENANTHRENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 ( )
PYRENE	0 (6)	0 (6)	0 (6)	0 (6)	50 (6)	83 (6)	0 ( )
4,4'-DDD	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	0 (6)	0 ( )
ANTIMONY	0 (6)	0 (6)	0 (6)	0 (6)	100 (5)	100 (5)	0 ( )
BERYLLIUM	0 (6)	0 (6)	0 (6)	0 (6)	67 (6)	50 (6)	0 ( )
SELENIUM	0 (6)	0 (6)	0 (6)	0 (6)	80 (5)	100 (5)	0 ( )

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 17

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER EFFLUENT	PRIMARY SLUDGE	COMBINED SLUDGE	SECONDARY SLUDGE
CONV.	BOD	MG/L	194	13	93	9	1695	45536	2819
	TOTAL SUSP. SOLIDS	MG/L	129	9	93	8	1603	189167	3893
	COD	MG/L	778	127	84	170	3320	64067	5687
	OIL & GREASE	MG/L	35	21	40	16	152	6817	488
NON-CONV.	TOTAL PHENOLS	UG/L	39	22	44	16	66	448	173
	TOTAL SOLIDS	MG/L	629	441	30	425	2328	55264	3996
	TOTAL DISS. SOLIDS	MG/L	462	444	4	419	NOT RUN	NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	25	L 1	96	L 1	97	1000	913
	TOTAL VOLATILE SOLIDS	MG/L	237	88	63	74	1619	42101	2974
	VOLATILE DISS. SOLIDS	MG/L	169	80	27	63	NOT RUN	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	95	6	94	7	1321	129363	3500
	AMMONIA NITROGEN	MG/L	38	18	53	21	26	108	24
	TOC	MG/L	95	28	71	25	283	4270	1179
VOLATILES	BENZENE	UG/L	1	L 1		L 1	1	7	0
	CARBON TETRACHLORIDE	UG/L	L 1	L 1		L 1	1	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	54	0	100	5	4	73	N-D
	1,1-DICHLOROETHANE	UG/L	1	L 1		L 1	14	65	N-D
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		L 1	N-D	32	N-D
	CHLOROFORM	UG/L	2	3		1	N-D	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	3	L 1	67	L 1	97	1620	51
	1,2-DICHLOROPROPANE	UG/L	L 1	L 1		L 1	N-D	79	N-D
	ETHYLBENZENE	UG/L	31	L 1	97	3	15	307	21
	METHYLENE CHLORIDE	UG/L	22	6	73	16	50	479	1
	METHYL CHLORIDE	UG/L	L 25	L 25		L 25	17	N-D	N-D
	DICHLORODIFLUOROMETHANE	UG/L	L 20	L 20		L 20	3	47	5
	TETRACHLOROETHYLENE	UG/L	124	4	97	22	1	14	N-D
	TOLUENE	UG/L	72	2	97	8	40	517	833
	TRICHLOROETHYLENE	UG/L	12	L 1	92	1	15	20	2
ACIDS.	PENTACHLOROPHENOL	UG/L	29	18	38	19	N-D	177	N-D
	PHENOL	UG/L	16	1	94	1	185	63	580
BASE-NEUT.	FLUORANTHENE	UG/L	L 3	L 3		L 3	N-D	169	N-D
	NAPHTHALENE	UG/L	3	L 2	33	L 2	N-D	707	112
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	24	9	63	5	461	5956	1395
	BUTYL BENZYL PHTHALATE	UG/L	3	L 2	33	L 2	27	910	N-D
	DI-N-BUTYL PHTHALATE	UG/L	2	3		3	N-D	239	7
	DIETHYL PHTHALATE	UG/L	4	L 3	25	L 3	N-D	N-D	N-D
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		L 5	N-D	111	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 17

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	OTHER EFFLUENT	PRIMARY SLUDGE	COMBINED SLUDGE	SECONDARY SLUDGE
BASE-NEUT.	CHRYSENE	UG/L	L 5	L 5		L 5	N-D	111	N-D
	ANTHRACENE	UG/L	L 3	L 3		L 3	31	460	N-D
	PHENANTHRENE	UG/L	L 3	L 3		L 3	31	460	N-D
	PYRENE	UG/L	L 3	L 3		L 3	N-D	165	N-D
PESTICIDES	HEPTACHLOR	NG/L	26	L 100		L 200	N-D	N-D	N-D
	ALPHA-BHC	NG/L	10	L 50		28	N-D	N-D	N-D
	BETA-BHC	NG/L	L 400	20		12	N-D	N-D	N-D
	GAMMA-BHC	NG/L	22	L 210		L 120	N-D	N-D	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	L 50	158	L 50
	ARSENIC	UG/L	L 50	L 50		L 50	16	282	16
	CADMIUM	UG/L	27	4	85	L 2	78	1362	357
	CHROMIUM	UG/L	108	34	69	34	177	5717	810
	COPPER	UG/L	165	35	81	12	598	16100	1663
	CYANIDE	UG/L	277	133	52	54	537	67517	960
	LEAD	UG/L	81	11	86	L 20	592	12300	1187
	MERCURY	NG/L	350	L 200	43	L 200	19167	47000	24167
	NICKEL	UG/L	34	22	35	44	104	1592	284
	SELENIUM	UG/L	L 50	L 50		L 50	L 100	168	L 100
	SILVER	UG/L	20	2	90	L 2	85	2900	277
	ZINC	UG/L	272	51	81	30	1163	31233	3317
N-C METALS	ALUMINUM	UG/L	958	116	88	78	NOT RUN	NOT RUN	NOT RUN
	BARIUM	UG/L	110	39	65	47	NOT RUN	NOT RUN	NOT RUN
	CALCIUM	MG/L	55	50	9	52	NOT RUN	NOT RUN	NOT RUN
	IRON	UG/L	1103	216	80	181	NOT RUN	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	9	9		9	NOT RUN	NOT RUN	NOT RUN
	MANGANESE	UG/L	130	104	20	107	NOT RUN	NOT RUN	NOT RUN
	SODIUM	MG/L	53	54		54	NOT RUN	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN;   N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 17

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	23715	12031	1592	6917	3522
	TOTAL SUSP. SOLIDS	15735	12447	1041	6542	4864
	COD	95226	36248	15592	13551	7105
	OIL & GREASE	4265	3781	2551	620	610
NON-CONVENTIONALS	TOTAL PHENOLS	4.7	3.1	2.6	.3	.2
	TOTAL SOLIDS	77042	68495	54001	9501	4993
	TOTAL DISS. SOLIDS	56552	-	54327	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	29021	21121	10796	6609	3716
	VOLATILE DISS. SOLIDS	13327	-	9796	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	11584	10499	735	5391	4373
	AMMONIA NITROGEN	4694	2338	2204	104	30.0
	TOC	11674	6057	3429	1155	1473
VOLATILES	BENZENE	.1	L 0.1	N-D	L 0.1	L 0.1
	CARBON TETRACHLORIDE	N-D	L 0.1	N-D	L 0.1	N-D
	1,1,1-TRICHLOROETHANE	6.6	L 0.1	L 0.1	L 0.1	N-D
	1,1-DICHLOROETHANE	.1	L 0.1	N-D	L 0.1	N-D
	CHLOROFORM	.3	.4	.4	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	.4	.5	N-D	.4	L 0.1
	ETHYLBENZENE	3.8	L 0.1	N-D	L 0.1	L 0.1
	METHYLENE CHLORIDE	2.7	1.0	.8	.2	L 0.1
	METHYL CHLORIDE	N-D	L 0.1	N-D	L 0.1	N-D
	DICHLORODIFLUOROMETHANE	N-D	L 0.1	N-D	L 0.1	L 0.1
	TETRACHLOROETHYLENE	15.2	.5	.5	L 0.1	N-D
	TOLUENE	8.8	1.4	.2	.2	1.0
	TRICHLOROETHYLENE	1.5	L 0.1	N-D	L 0.1	L 0.1
ACID EXTRACT	PENTACHLOROPHENOL	3.6	2.1	2.1	N-D	N-D
	PHENOL	2.0	1.6	L 0.1	.8	.7
BASE-NEUTRALS	NAPHTHALENE	.4	.1	N-D	N-D	.1
	BIS(2-ETHYLHEXYL) PHTHALATE	2.9	4.7	1.1	1.9	1.7
	BUTYL BENZYL PHTHALATE	.3	.1	N-D	.1	N-D
	DI-N-BUTYL PHTHALATE	.2	.4	.4	N-D	L 0.1
	DIETHYL PHTHALATE	.5	N-D	N-D	N-D	N-D
	ANTHRACENE	N-D	.1	N-D	.1	N-D
	PHENANTHRENE	N-D	.1	N-D	.1	N-D
PESTICIDES	HEPTACHLOR	L 0.1	N-D	N-D	N-D	N-D
	ALPHA-BHC	L 0.1	N-D	N-D	N-D	N-D
	BETA-BHC	N-D	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	L 0.1	N-D	N-D	N-D	N-D
METALS	ARSENIC	N-D	L 0.1	N-D	L 0.1	L 0.1
	CADMIUM	3.3	1.2	.5	.3	.4
	CHROMIUM	13.2	5.9	4.2	.7	1.0
	COPPER	22.6	8.8	4.3	2.4	2.1
	CYANIDE	33.9	19.6	16.2	2.2	1.2
	LEAD	9.9	5.3	1.4	2.4	1.5
	MERCURY	L 0.1	.1	N-D	L 0.1	L 0.1
	NICKEL	4.2	3.5	2.7	.4	.4

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 17

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	SILVER	2.4	.8	.2	.3	.3
	ZINC	33.3	15.0	6.2	4.7	4.1
NON-CONV. METALS	ALUMINUM	117	-	14.2	NOT RUN	NOT RUN
	BARIUM	13.4	-	4.7	NOT RUN	NOT RUN
	CALCIUM	6755	-	6143	NOT RUN	NOT RUN
	IRON	135	-	26.4	NOT RUN	NOT RUN
	MAGNESIUM	1102	-	1061	NOT RUN	NOT RUN
	MANGANESE	15.9	-	12.8	NOT RUN	NOT RUN
	SODIUM	6510	-	6592	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 17

PARAMETER	INFL-UENT		SEC. EFFL.		OTHER EFFL		PRIM. SLDG.		COMB. SLDG		SEC. SLDG		TAP WATER	
1,1,1-TRICHLOROETHANE	100	(6)	33	(6)	100	(6)	17	(6)	50	(6)	0	(6)	0	(1)
CHLOROFORM	100	(6)	100	(6)	83	(6)	0	(6)	0	(6)	0	(6)	100	(1)
1,2-TRANS-DICHLOROETHYLENE	100	(6)	0	(6)	0	(6)	100	(6)	100	(6)	83	(6)	0	(1)
ETHYLBENZENE	100	(6)	0	(6)	67	(6)	100	(6)	100	(6)	83	(6)	0	(1)
METHYLENE CHLORIDE	100	(6)	100	(6)	100	(6)	50	(6)	83	(6)	17	(6)	0	(1)
TETRACHLOROETHYLENE	100	(6)	100	(6)	100	(6)	17	(6)	50	(6)	0	(6)	0	(1)
TOLUENE	100	(6)	67	(6)	50	(6)	100	(6)	100	(6)	100	(6)	0	(1)
TRICHLOROETHYLENE	100	(6)	0	(6)	67	(6)	100	(6)	17	(6)	17	(6)	0	(1)
PHENOL	100	(6)	67	(6)	50	(6)	33	(6)	50	(6)	67	(6)	0	(1)
BIS(2-ETHYLHEXYL) PHTHALATE	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)	83	(6)	0	(1)
CADMIUM	100	(6)	67	(6)	0	(6)	100	(6)	100	(6)	100	(6)	0	(1)
CHROMIUM	100	(6)	83	(6)	100	(6)	50	(6)	100	(6)	100	(6)	0	(1)
COPPER	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)	100	(6)	100	(1)
CYANIDE	100	(6)	100	(6)	100	(5)	100	(6)	100	(6)	100	(6)	0	( )
LEAD	100	(6)	33	(6)	0	(6)	100	(5)	100	(6)	100	(6)	0	(1)
MERCURY	100	(6)	0	(6)	0	(6)	33	(6)	100	(6)	50	(6)	0	(1)
SILVER	100	(6)	33	(6)	0	(6)	83	(6)	100	(6)	100	(6)	0	(1)
ZINC	100	(6)	100	(6)	83	(6)	100	(6)	100	(6)	100	(6)	0	(1)
PENTACHLOROPHENOL	83	(6)	67	(6)	67	(6)	0	(6)	33	(6)	0	(6)	0	(1)
NICKEL	83	(6)	83	(6)	100	(6)	100	(6)	100	(6)	100	(6)	0	(1)
BUTYL BENZYL PHTHALATE	67	(6)	0	(6)	0	(6)	17	(6)	100	(6)	0	(6)	0	(1)
DIETHYL PHTHALATE	67	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(1)
1,1-DICHLOROETHANE	50	(6)	0	(6)	0	(6)	100	(6)	83	(6)	0	(6)	0	(1)
NAPHTHALENE	50	(6)	0	(6)	0	(6)	0	(6)	83	(6)	17	(6)	0	(1)
BENZENE	33	(6)	0	(6)	0	(6)	33	(6)	50	(6)	17	(6)	0	(1)
DI-N-BUTYL PHTHALATE	33	(6)	83	(6)	83	(6)	0	(6)	100	(6)	17	(6)	100	(1)
HEPTACHLOR	17	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(1)
ALPHA-BHC	17	(6)	0	(6)	17	(6)	0	(6)	0	(6)	0	(6)	0	(1)
GAMMA-BHC	17	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(6)	0	(1)
CARBON TETRACHLORIDE	0	(6)	0	(6)	0	(6)	17	(6)	0	(6)	0	(6)	0	(1)
1,1,2,2-TETRACHLOROETHANE	0	(6)	0	(6)	0	(6)	0	(6)	33	(6)	0	(6)	0	(1)
1,2-DICHLOROPROPANE	0	(6)	0	(6)	0	(6)	0	(6)	100	(6)	0	(6)	0	(1)
METHYL CHLORIDE	0	(6)	0	(6)	0	(6)	33	(6)	0	(6)	0	(6)	0	(1)
DICHLORODIFLUOROMETHANE	0	(6)	0	(6)	0	(6)	17	(6)	33	(6)	17	(6)	0	(1)
FLUORANTHENE	0	(6)	0	(6)	0	(6)	0	(6)	100	(6)	0	(6)	0	(1)
1,2-BENZANTHRACENE	0	(6)	0	(6)	0	(6)	0	(6)	83	(6)	0	(6)	0	(1)
CHRYSENE	0	(6)	0	(6)	0	(6)	0	(6)	83	(6)	0	(6)	0	(1)
ANTHRACENE	0	(6)	0	(6)	0	(6)	33	(6)	83	(6)	0	(6)	0	(1)
PHENANTHRENE	0	(6)	0	(6)	0	(6)	33	(6)	83	(6)	0	(6)	0	(1)
PYRENE	0	(6)	0	(6)	0	(6)	0	(6)	100	(6)	0	(6)	0	(1)
BETA-BHC	0	(6)	33	(6)	17	(6)	0	(6)	0	(6)	0	(6)	0	(1)
ANTIMONY	0	(6)	0	(6)	0	(6)	0	(5)	100	(5)	0	(5)	0	(1)
ARSENIC	0	(6)	0	(6)	0	(6)	33	(6)	100	(6)	17	(6)	0	(1)
SELENIUM	0	(6)	0	(6)	0	(6)	0	(5)	100	(5)	0	(5)	0	(1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 18

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	MG/L	208	37	82	25243	8554
	TOTAL SUSP. SOLIDS	MG/L	268	21	92	182900	17933
	COD	MG/L	717	82	89	97333	17547
	OIL & GREASE	MG/L	46	17	63	9100	853
NON-CONVENTIONALS	TOTAL PHENOLS	UG/L	56	12	79	824	61
	TOTAL SOLIDS	MG/L	476	279	42	84607	11039
	TOTAL DISS. SOLIDS	MG/L	216	239		NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	11	L 1	91	997	994
	TOTAL VOLATILE SOLIDS	MG/L	198	42	79	44464	7511
	VOLATILE DISS. SOLIDS	MG/L	102	57	44	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	152	15	90	98700	12866
	AMMONIA NITROGEN	MG/L	10	7	30	67	10
	TOC	MG/L	162	36	78	862	389
VOLATILES	BENZENE	UG/L	9	L 1	89	44	1
	1,2-DICHLOROETHANE	UG/L	0	L 1		N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	63	9	86	175	N-D
	1,1-DICHLOROETHANE	UG/L	2	L 1	50	15	4
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		277	12
	CHLOROFORM	UG/L	2	0	100	19	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	L 1	L 1		227	4
	ETHYLBENZENE	UG/L	12	L 1	92	832	6
	METHYLENE CHLORIDE	UG/L	50	13	74	44	2
	TRICHLOROFLUOROMETHANE	UG/L	0	L 1		44	N-D
	TETRACHLOROETHYLENE	UG/L	9	4	56	N-D	N-D
	TOLUENE	UG/L	34	L 1	97	398	31
	TRICHLOROETHYLENE	UG/L	23	3	87	245	3
ACID EXTRACT	2-CHLOROPHENOL	UG/L	0	L 1		20	N-D
	2,4-DICHLOROPHENOL	UG/L	2	1	50	144	N-D
	2,4-DIMETHYLPHENOL	UG/L	0	L 2		N-D	N-D
	PENTACHLOROPHENOL	UG/L	1	L 5		N-D	N-D
	PHENOL	UG/L	20	0	100	113	223
BASE-NEUTRALS	NAPHTHALENE	UG/L	2	L 2		331	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	70	46	31	4225	8072
	BUTYL BENZYL PHTHALATE	UG/L	4	L 2	50	1231	44
	DI-N-BUTYL PHTHALATE	UG/L	4	2	50	357	77
	DI-N-OCTYL PHTHALATE	UG/L	38	2	95	94	311
	DIETHYL PHTHALATE	UG/L	L 3	L 3		N-D	131

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN;   N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 18

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	1,2-BENZANTHRACENE	UG/L	L 5	L 5		137	N-D
	CHRYSENE	UG/L	L 5	L 5		137	N-D
	ANTHRACENE	UG/L	L 3	L 3		1123	N-D
	FLUORENE	UG/L	L 3	L 3		214	N-D
	PHENANTHRENE	UG/L	L 3	L 3		1123	N-D
	PYRENE	UG/L	L 3	L 3		109	N-D
PESTICIDES	CHLORDANE	NG/L	L 2000	33		N-D	N-D
	ALPHA-BHC	NG/L	25	52		N-D	N-D
	GAMMA-BHC	NG/L	72	63	13	N-D	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		223	50
	ARSENIC	UG/L	L 50	L 50		350	57
	CADMIUM	UG/L	2	L 2		347	143
	CHROMIUM	UG/L	51	11	78	3550	563
	COPPER	UG/L	117	6	95	14733	3283
	CYANIDE	UG/L	169	113	33	25250	5233
	LEAD	UG/L	136	23	83	25500	5200
	MERCURY	NG/L	517	200	61	203333	4833
	NICKEL	UG/L	24	14	42	1348	352
	SELENIUM	UG/L	L 50	L 50		123	L 100
	SILVER	UG/L	15	3	80	1078	558
	ZINC	UG/L	330	75	77	32333	13950
NON-CONV. METALS	ALUMINUM	UG/L	4910	417	92	NOT RUN	NOT RUN
	BARIUM	UG/L	111	17	85	NOT RUN	NOT RUN
	CALCIUM	MG/L	16	13	19	NOT RUN	NOT RUN
	IRON	UG/L	4103	366	91	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	4	3	25	NOT RUN	NOT RUN
	MANGANESE	UG/L	162	93	43	NOT RUN	NOT RUN
	SODIUM	MG/L	45	49		NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 18

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	108376	84986	19207	29438	36341
	TOTAL SUSP. SOLIDS	139646	300539	11055	213298	76186
	COD	373712	230814	42760	113510	74544
	OIL & GREASE	23813	22928	8691	10612	3625
NON-CONVENTIONALS	TOTAL PHENOLS	30.3	7.6	6.3	1.0	.3
	TOTAL SOLIDS	249257	291139	145574	98669	46896
	TOTAL DISS. SOLIDS	112809	-	124628	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	103249	105665	21901	51854	31910
	VOLATILE DISS. SOLIDS	53189	-	29723	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	79053	177586	7822	115104	54660
	AMMONIA NITROGEN	5215	3597	3476	78.3	43.2
	TOC	84215	21342	18686	1005	1651
VOLATILES	BENZENE	4.8	L 0.1	N-D	L 0.1	L 0.1
	1,2-DICHLOROETHANE	L 0.1	N-D	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	32.6	5.1	4.9	.2	N-D
	1,1-DICHLOROETHANE	.9	L 0.1	N-D	L 0.1	L 0.1
	1,1,2,2-TETRACHLOROETHANE	N-D	.3	N-D	.3	L 0.1
	CHLOROFORM	.9	.1	L 0.1	L 0.1	N-D
	1,2-TRANS-DICHLOROETHYLENE	N-D	.3	N-D	.3	L 0.1
	ETHYLBENZENE	6.3	1.0	N-D	1.0	L 0.1
	METHYLENE CHLORIDE	26.0	7.0	6.9	L 0.1	L 0.1
	TRICHLOROFLUOROMETHANE	L 0.1	L 0.1	N-D	L 0.1	N-D
	TETRACHLOROETHYLENE	4.5	2.2	2.2	N-D	N-D
	TOLUENE	17.6	.6	N-D	.5	.1
	TRICHLOROETHYLENE	11.7	2.0	1.7	.3	L 0.1
ACID EXTRACT	2-CHLOROPHENOL	L 0.1	L 0.1	N-D	L 0.1	N-D
	2,4-DICHLOROPHENOL	1.0	.5	.3	.2	N-D
	2,4-DIMETHYLPHENOL	.2	N-D	N-D	N-D	N-D
	PENTACHLOROPHENOL	.7	N-D	N-D	N-D	N-D
	PHENOL	10.5	1.1	L 0.1	.1	.9
BASE-NEUTRALS	NAPHTHALENE	.9	.4	N-D	.4	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	36.4	64.0	24.8	4.9	34.3
	BUTYL BENZYL PHTHALATE	1.8	1.6	N-D	1.4	.2
	DI-N-BUTYL PHTHALATE	1.9	1.5	.8	.4	.3
	DI-N-OCTYL PHTHALATE	19.8	2.5	1.1	.1	1.3
	DIETHYL PHTHALATE	N-D	.6	N-D	N-D	.6
	1,2-BENZANTHRACENE	N-D	.2	N-D	.2	N-D
	CHRYSENE	N-D	.2	N-D	.2	N-D
	ANTHRACENE	N-D	1.3	N-D	1.3	N-D
	FLUORENE	N-D	.2	N-D	.2	N-D
	PHENANTHRENE	N-D	1.3	N-D	1.3	N-D
	PYRENE	N-D	.1	N-D	.1	N-D
PESTICIDES	CHLORDANE	N-D	L 0.1	L 0.1	N-D	N-D
	ALPHA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
	GAMMA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
METALS	ANTIMONY	N-D	.5	N-D	.3	.2

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 18

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	ARSENIC	N-D	.6	N-D	.4	.2
	CADMIUM	1.2	1.0	N-D	.4	.6
	CHROMIUM	26.7	12.1	5.6	4.1	2.4
	COPPER	61.1	34.4	3.3	17.2	13.9
	CYANIDE	88.0	110	58.9	29.4	22.2
	LEAD	70.7	63.9	12.1	29.7	22.1
	MERCURY	.3	.3	.1	.2	L 0.1
	NICKEL	12.4	10.4	7.3	1.6	1.5
	SELENIUM	N-D	.1	N-D	.1	N-D
	SILVER	7.6	5.0	1.3	1.3	2.4
	ZINC	172	136	38.8	37.7	59.3
NON-CONV. METALS	ALUMINUM	2560	-	218	NOT RUN	NOT RUN
	BARIUM	58.0	-	8.8	NOT RUN	NOT RUN
	CALCIUM	8343	-	6866	NOT RUN	NOT RUN
	IRON	2140	-	191	NOT RUN	NOT RUN
	MAGNESIUM	1912	-	1391	NOT RUN	NOT RUN
	MANGANESE	84.3	-	48.4	NOT RUN	NOT RUN
	SODIUM	23205	-	25638	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 18

PARAMETER	INFL-UENT	SECONDARY EFFL.	PRIM. SLDG	SEC. SLDG	TAP WATER
1,1,1-TRICHLOROETHANE	100 (6)	100 (6)	100 (6)	0 (6)	0 (1)
METHYLENE CHLORIDE	100 (6)	83 (6)	100 (6)	83 (6)	100 (1)
TETRACHLOROETHYLENE	100 (6)	100 (6)	0 (6)	0 (6)	100 (1)
TOLUENE	100 (6)	0 (6)	100 (6)	100 (6)	0 (1)
TRICHLOROETHYLENE	100 (6)	100 (6)	100 (6)	40 (5)	0 (1)
CHROMIUM	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
COPPER	100 (6)	83 (6)	100 (6)	100 (6)	100 (1)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	0 ( )
LEAD	100 (6)	67 (6)	100 (6)	100 (6)	0 (1)
MERCURY	100 (6)	83 (6)	100 (6)	17 (6)	0 (1)
NICKEL	100 (6)	83 (6)	100 (6)	100 (6)	0 (1)
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
BENZENE	83 (6)	0 (6)	100 (6)	33 (6)	0 (1)
CHLOROFORM	83 (6)	17 (6)	67 (6)	0 (6)	100 (1)
ETHYLBENZENE	83 (6)	0 (6)	83 (6)	33 (6)	0 (1)
PHENOL	83 (6)	17 (6)	83 (6)	100 (6)	0 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	83 (6)	83 (6)	100 (6)	100 (6)	100 (1)
BUTYL BENZYL PHTHALATE	83 (6)	0 (6)	83 (6)	33 (6)	0 (1)
SILVER	83 (6)	67 (6)	100 (6)	100 (6)	0 (1)
GAMMA-BHC	67 (6)	100 (6)	0 (6)	0 (6)	0 (1)
CADMIUM	50 (6)	0 (6)	100 (6)	100 (6)	0 (1)
1,1-DICHLOROETHANE	33 (6)	0 (6)	33 (6)	50 (6)	0 (1)
NAPHTHALENE	33 (6)	0 (6)	100 (6)	0 (6)	0 (1)
DI-N-BUTYL PHTHALATE	33 (6)	67 (6)	100 (6)	67 (6)	0 (1)
DI-N-OCTYL PHTHALATE	33 (6)	17 (6)	17 (6)	33 (6)	0 (1)
1,2-DICHLOROETHANE	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
TRICHLOROFLUOROMETHANE	17 (6)	0 (6)	100 (6)	0 (6)	0 (1)
2-CHLOROPHENOL	17 (6)	0 (6)	33 (6)	0 (6)	0 (1)
2,4-DICHLOROPHENOL	17 (6)	17 (6)	100 (6)	0 (6)	0 (1)
2,4-DIMETHYLPHENOL	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
PENTACHLOROPHENOL	17 (6)	0 (6)	0 (6)	0 (6)	0 (1)
ALPHA-BHC	17 (6)	33 (6)	0 (6)	0 (6)	0 (1)
1,1,2,2-TETRACHLOROETHANE	0 (6)	0 (6)	83 (6)	83 (6)	0 (1)
1,2-TRANS-DICHLOROETHYLENE	0 (6)	0 (6)	100 (6)	50 (6)	0 (1)
DIETHYL PHTHALATE	0 (6)	0 (6)	0 (6)	17 (6)	0 (1)
1,2-BENZANTHRACENE	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
CHRYSENE	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
ANTHRACENE	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
FLUORENE	0 (6)	0 (6)	67 (6)	0 (6)	0 (1)
PHENANTHRENE	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
PYRENE	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
CHLORDANE	0 (6)	17 (6)	0 (6)	0 (6)	0 (1)
ANTIMONY	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
ARSENIC	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
SELENIUM	0 (6)	0 (6)	67 (6)	0 (6)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 19

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY EFFLUENT	PRE CL EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONV.	BOD	MG/L	379	37	90	325	45	19693	8989
	TOTAL SUSP. SOLIDS	MG/L	167	22	88	132	29	79583	22500
	COD	MG/L	723	141	80	698	146	94400	21734
	OIL & GREASE	MG/L	112	15	87	37	16	7920	512
NON-CONV.	TOTAL PHENOLS	UG/L	258	35	86	271	48	684	205
	TOTAL SOLIDS	MG/L	1061	762	28	1007	756	58303	18044
	TOTAL DISS. SOLIDS	MG/L	745	722	3	671	674	NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	8	L 1	88	1	L 1	1000	984
	TOTAL VOLATILE SOLIDS	MG/L	380	128	66	336	120	40131	13354
	VOLATILE DISS. SOLIDS	MG/L	95	109		79	82	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	134	13	90	77	21	47550	13667
	AMMONIA NITROGEN	MG/L	34	19	44	28	25	97	52
	TOC	MG/L	211	67	68	187	73	981	675
VOLATILES	BENZENE	UG/L	4	L 1	75	3	L 1	15	2
	CHLOROBENZENE	UG/L	3	L 1	67	2	L 1	N-D	N-D
	1,2-DICHLOROETHANE	UG/L	1	1		1	1	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	49	30	39	31	31	115	67
	1,1-DICHLOROETHANE	UG/L	0	0		1	1	10	19
	1,1,2,2-TETRACHLOROETHANE	UG/L	L 1	L 1		0	L 1	657	1
	CHLOROFORM	UG/L	18	16	11	14	14	29	19
	1,2-TRANS-DICHLOROETHYLENE	UG/L	5	L 1	80	2	L 1	7	341
	1,2-DICHLOROPROPANE	UG/L	2	1	50	1	1	N-D	N-D
	ETHYLBENZENE	UG/L	21	4	81	20	3	336	14
	METHYLENE CHLORIDE	UG/L	93	68	27	66	61	32	29
	METHYL CHLORIDE	UG/L	32	340		574	375	N-D	N-D
	METHYL BROMIDE	UG/L	L 20	36		110	42	N-D	N-D
	TRICHLOROFLUOROMETHANE	UG/L	0	L 1		0	L 1	N-D	N-D
	DICHLORODIFLUOROMETHANE	UG/L	167	L 20	88	130	L 20	N-D	N-D
	TETRACHLOROETHYLENE	UG/L	15	18		22	18	N-D	N-D
	TOLUENE	UG/L	60	3	95	61	2	980	32
	TRICHLOROETHYLENE	UG/L	32	18	44	25	17	376	28
	VINYL CHLORIDE	UG/L	19	L 20		72	L 20	N-D	N-D
ACIDS.	2,4,6-TRICHLOROPHENOL	UG/L	L 2	L 2		0	L 2	5	N-D
	2-CHLOROPHENOL	UG/L	2	L 1	50	3	L 1	28	N-D
	2,4-DICHLOROPHENOL	UG/L	L 2	1		0	1	12	N-D
	2,4-DIMETHYLPHENOL	UG/L	2	1	50	1	3	N-D	N-D
	PENTACHLOROPHENOL	UG/L	L 5	L 5		L 5	L 5	20	N-D
	PHENOL	UG/L	130	0	100	57	0	501	118

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN;   N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 19

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	PRIMARY EFFLUENT	PRE CL EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUT.	1,2,4-TRICHLOROBENZENE	UG/L	L 5	L 5		L 5	L 5	479	64
	1,2-DICHLOROBENZENE	UG/L	7	5	29	6	3	911	112
	1,3-DICHLOROBENZENE	UG/L	L 5	L 5		L 5	L 5	300	41
	1,4-DICHLOROBENZENE	UG/L	2	2		1	1	519	70
	FLUORANTHENE	UG/L	L 4	L 4		L 4	L 4	114	32
	NAPHTHALENE	UG/L	3	L 3		4	L 3	471	2
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	33	20	39	38	20	5038	1914
	BUTYL BENZYL PHTHALATE	UG/L	19	L 3	84	12	L 3	3428	N-D
	DI-N-BUTYL PHTHALATE	UG/L	1	L 4		L 4	L 4	377	21
	DI-N-OCTYL PHTHALATE	UG/L	L 5	L 5		2	L 5	19	6
	DIETHYL PHTHALATE	UG/L	3	L 5		3	L 5	N-D	N-D
	ANTHRACENE	UG/L	L 5	L 5		L 5	L 5	229	N-D
	PHENANTHRENE	UG/L	L 5	L 5		L 5	L 5	229	N-D
	PYRENE	UG/L	L 4	L 4		L 4	L 4	32	11
PESTICIDES	4,4'-DDE	NG/L	L 200	L 200		L 200	L 200	N-D	1667
	4,4'-DDD	NG/L	128	L 300		L 300	L 300	N-D	N-D
	HEPTACHLOR	NG/L	35	L 100		L 100	L 100	N-D	N-D
	GAMMA-BHC	NG/L	105	57	46	120	28	N-D	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	L 50	150	82
	ARSENIC	UG/L	L 50	L 50		L 50	L 50	265	131
	CADMIUM	UG/L	9	L 2	78	8	L 2	917	2727
	CHROMIUM	UG/L	107	26	76	83	23	5350	1343
	COPPER	UG/L	98	16	84	84	15	12383	2917
	CYANIDE	UG/L	714	337	53	509	247	188000	33917
	LEAD	UG/L	47	L 50		10	L 50	12383	5100
	MERCURY	NG/L	600	83	86	683	100	219000	79167
	NICKEL	UG/L	54	44	19	58	45	2042	348
	SELENIUM	UG/L	L 50	L 50		L 50	25	147	17
	SILVER	UG/L	10	L 5	50	10	L 5	850	410
	ZINC	UG/L	224	38	83	249	43	26383	16983
N-C METALS	ALUMINUM	UG/L	3554	337	91	2988	325	NOT RUN	NOT RUN
	BARIUM	UG/L	120	18	85	103	18	NOT RUN	NOT RUN
	CALCIUM	MG/L	28	25	11	27	25	NOT RUN	NOT RUN
	IRON	UG/L	2035	843	59	2257	658	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	16	16		16	16	NOT RUN	NOT RUN
	MANGANESE	UG/L	143	111	22	125	109	NOT RUN	NOT RUN
	SODIUM	MG/L	150	152		148	149	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED HERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

FLANT 19

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	214049	138902	20803	49212	68887
	TOTAL SUSP. SOLIDS	105330	383547	12237	198879	172431
	COD	408143	482285	79821	235906	166558
	OIL & GREASE	63396	32376	8660	19792	3924
NON-CONVENTIONALS	TOTAL PHENOLS	146	22.8	19.5	1.7	1.6
	TOTAL SOLIDS	599225	714432	430452	145698	138282
	TOTAL DISS. SOLIDS	420568	-	407861	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	214614	274824	72197	100287	102340
	VOLATILE DISS. SOLIDS	53842	-	61560	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	75868	230811	7248	118827	104736
	AMMONIA NITROGEN	19202	11273	10637	241	395
	TOC	118885	45652	38028	2451	5173
VOLATILES	BENZENE	2.1	L 0.1	N-D	L 0.1	L 0.1
	CHLOROBENZENE	1.7	N-D	N-D	N-D	N-D
	1,2-DICHLOROETHANE	.7	.8	.8	N-D	N-D
	1,1,1-TRICHLOROETHANE	27.5	17.8	17.0	.3	.5
	1,1-DICHLOROETHANE	.2	.2	L 0.1	L 0.1	.1
	1,1,2,2-TETRACHLOROETHANE	N-D	1.6	N-D	1.6	L 0.1
	CHLOROFORM	10.4	9.4	9.2	L 0.1	.1
	1,2-TRANS-DICHLOROETHYLENE	2.9	2.6	N-D	L 0.1	2.6
	1,2-DICHLOROPROPANE	.8	.4	.4	N-D	N-D
	ETHYLBENZENE	12.0	3.3	2.4	.8	.1
	METHYLENE CHLORIDE	52.6	38.9	38.6	L 0.1	.2
	METHYL CHLORIDE	18.1	192	192	N-D	N-D
	METHYL BROMIDE	N-D	21.4	21.4	N-D	N-D
	TRICHLOROFLUOROMETHANE	.2	N-D	N-D	N-D	N-D
	DICHLORODIFLUOROMETHANE	94.1	N-D	N-D	N-D	N-D
	TETRACHLOROETHYLENE	8.6	10.4	10.4	N-D	N-D
	TOLUENE	34.0	4.1	1.5	2.4	.2
	TRICHLOROETHYLENE	17.9	11.2	10.1	.9	.2
	VINYL CHLORIDE	10.9	N-D	N-D	N-D	N-D
ACID EXTRACT	2,4,6-TRICHLOROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	2-CHLOROPHENOL	1.2	L 0.1	N-D	L 0.1	N-D
	2,4-DICHLOROPHENOL	N-D	.6	.6	L 0.1	N-D
	2,4-DIMETHYLPHENOL	1.0	.4	.4	N-D	N-D
	PENTACHLOROPHENOL	N-D	L 0.1	N-D	L 0.1	N-D
	PHENOL	73.4	2.3	L 0.1	1.3	.9
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	N-D	1.7	N-D	1.2	.5
	1,2-DICHLOROBENZENE	4.0	5.7	2.5	2.3	.9
	1,3-DICHLOROBENZENE	N-D	1.0	N-D	.7	.3
	1,4-DICHLOROBENZENE	1.3	2.6	.8	1.3	.5
	FLUORANTHENE	N-D	.5	N-D	.3	.2
	NAPHTHALENE	1.6	1.2	N-D	1.2	L 0.1
	BIS(2-ETHYLHEXYL) PHTHALATE	18.4	38.3	11.0	12.6	14.7
	BUTYL BENZYL PHTHALATE	10.5	8.6	N-D	8.6	N-D
	DI-N-BUTYL PHTHALATE	.7	1.1	N-D	.9	.2
	DI-N-OCTYL PHTHALATE	N-D	L 0.1	N-D	L 0.1	L 0.1
	DIETHYL PHTHALATE	1.7	N-D	N-D	N-D	N-D

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 19

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
BASE-NEUTRALS	ANTHRACENE	N-D	.6	N-D	.6	N-D
	PHENANTHRENE	N-D	.6	N-D	.6	N-D
	PYRENE	N-D	.2	N-D	L 0.1	L 0.1
PESTICIDES	4,4'-DDE	N-D	L 0.1	N-D	N-D	L 0.1
	4,4'-DDD	L 0.1	N-D	N-D	N-D	N-D
	HEPTACHLOR	L 0.1	N-D	N-D	N-D	N-D
	GAMMA-BHC	L 0.1	L 0.1	L 0.1	N-D	N-D
METALS	ANTIMONY	N-D	1.0	N-D	.4	.6
	ARSENIC	N-D	1.7	N-D	.7	1.0
	CADMIUM	4.9	23.2	N-D	2.3	20.9
	CHROMIUM	60.3	38.4	14.7	13.4	10.3
	COPPER	55.1	62.1	8.8	30.9	22.4
	CYANIDE	403	920	190	470	260
	LEAD	26.5	70.0	N-D	30.9	39.1
	MERCURY	.3	1.1	L 0.1	.5	.6
	NICKEL	30.4	32.8	25.0	5.1	2.7
	SELENIUM	N-D	.5	N-D	.4	.1
	SILVER	5.8	5.2	N-D	2.1	3.1
	ZINC	126	217	21.2	65.9	130
NON-CONV. METALS	ALUMINUM	2007	-	190	NOT RUN	NOT RUN
	BARIUM	67.7	-	9.9	NOT RUN	NOT RUN
	CALCIUM	15625	-	14308	NOT RUN	NOT RUN
	IRON	1149	-	476	NOT RUN	NOT RUN
	MAGNESIUM	9131	-	9131	NOT RUN	NOT RUN
	MANGANESE	80.9	-	62.4	NOT RUN	NOT RUN
	SODIUM	84904	-	85657	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 19

PARAMETER	INFL-UENT	PRIM. EFFL.	PRE CL. EFFL	SEC. EFFL.	PRIM. SLDG	SEC. SLDG	TAP WATER
BENZENE	100 (6)	100 (6)	0 (6)	0 (6)	67 (6)	67 (6)	0 (1)
1,1,1-TRICHLOROETHANE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
CHLOROFORM	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
ETHYLBENZENE	100 (6)	100 (6)	100 (6)	83 (6)	100 (6)	83 (6)	0 (1)
METHYLENE CHLORIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
TETRACHLOROETHYLENE	100 (6)	100 (6)	100 (6)	100 (6)	0 (6)	0 (6)	0 (1)
TOLUENE	100 (6)	100 (6)	100 (6)	83 (6)	100 (6)	100 (6)	0 (1)
TRICHLOROETHYLENE	100 (6)	100 (6)	83 (6)	100 (6)	100 (6)	67 (6)	0 (1)
PHENOL	100 (6)	100 (6)	17 (6)	17 (6)	100 (6)	83 (6)	0 (1)
BUTYL BENZYL PHTHALATE	100 (6)	83 (6)	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
CHROMIUM	100 (6)	100 (6)	83 (6)	100 (6)	100 (6)	100 (6)	0 (1)
COPPER	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (1)
MERCURY	100 (6)	100 (6)	33 (6)	33 (6)	100 (6)	100 (6)	0 (1)
NICKEL	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
ZINC	100 (6)	100 (6)	83 (6)	83 (6)	100 (6)	100 (6)	100 (1)
CHLOROBENZENE	83 (6)	83 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-TRANS-DICHLOROETHYLENE	83 (6)	83 (6)	0 (6)	0 (6)	17 (6)	100 (6)	0 (1)
1,2-DICHLOROPROPANE	83 (6)	50 (6)	83 (6)	67 (6)	0 (6)	0 (6)	0 (1)
BIS(2-ETHYLHEXYL) PHTHALATE	83 (6)	83 (6)	100 (6)	100 (6)	100 (6)	100 (6)	0 (1)
CADMIUM	83 (6)	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
SILVER	83 (6)	100 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
2-CHLOROPHENOL	67 (6)	83 (6)	0 (6)	0 (6)	83 (6)	0 (6)	0 (1)
NAPHTHALENE	67 (6)	83 (6)	0 (6)	0 (6)	100 (6)	17 (6)	0 (1)
GAMMA-BHC	67 (6)	67 (6)	33 (6)	50 (6)	0 (6)	0 (6)	0 (1)
LEAD	67 (6)	17 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
2,4-DIMETHYLPHENOL	50 (6)	50 (6)	67 (6)	17 (6)	0 (6)	0 (6)	0 (1)
DIETHYL PHTHALATE	50 (6)	50 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-DICHLOROETHANE	33 (6)	33 (6)	33 (6)	33 (6)	0 (6)	0 (6)	0 (1)
1,1-DICHLOROETHANE	33 (6)	33 (6)	33 (6)	17 (6)	33 (6)	100 (6)	0 (1)
METHYL CHLORIDE	33 (6)	100 (6)	100 (6)	83 (6)	0 (6)	0 (6)	0 (1)
VINYL CHLORIDE	33 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,2-DICHLOROBENZENE	33 (6)	50 (6)	33 (6)	50 (6)	100 (6)	100 (6)	0 (1)
1,4-DICHLOROBENZENE	33 (6)	17 (6)	17 (6)	17 (6)	100 (6)	100 (6)	0 (1)
TRICHLOROFLUOROMETHANE	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
DICHLORODIFLUOROMETHANE	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
DI-N-BUTYL PHTHALATE	17 (6)	0 (6)	0 (6)	0 (6)	100 (6)	33 (6)	0 (1)
4,4′-DDD	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
HEPTACHLOR	17 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	0 (1)
1,1,2,2-TETRACHLOROETHANE	0 (6)	17 (6)	0 (6)	0 (6)	100 (6)	33 (6)	0 (1)
METHYL BROMIDE	0 (6)	17 (6)	33 (6)	33 (6)	0 (6)	0 (6)	0 (1)
2,4,6-TRICHLOROPHENOL	0 (6)	17 (6)	0 (6)	0 (6)	33 (6)	0 (6)	0 (1)
2,4-DICHLOROPHENOL	0 (6)	17 (6)	33 (6)	33 (6)	50 (6)	0 (6)	0 (1)
PENTACHLOROPHENOL	0 (6)	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)	0 (1)
1,2,4-TRICHLOROBENZENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	83 (6)	0 (1)
1,3-DICHLOROBENZENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	67 (6)	0 (1)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
DI-N-OCTYL PHTHALATE	0 (6)	17 (6)	0 (6)	0 (6)	17 (6)	17 (6)	0 (1)
ANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
PHENANTHRENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	0 (6)	0 (1)
PYRENE	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	67 (6)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 19

PARAMETER	INFL-UENT	PRIM. EFFL.	PRE CL. EFFL	SEC. EFFL.	PRIM. SLDG	SEC. SLDG	TAP WATER
4,4'-DDE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	17 (6)	0 (1)
ANTIMONY	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
ARSENIC	0 (6)	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	0 (1)
SELENIUM	0 (6)	0 (6)	17 (6)	0 (6)	83 (6)	17 (6)	0 (1)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

SU'MARY OF ANALYTICAL DATA

PLANT 20

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	TERTIARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE	NITRIFICATION SLUDGE
CONV.	BOD	MG/L	247	21	91	8	15833	7543	8350
	TOTAL SUSP. SOLIDS	MG/L	421	13	97	5	67833	16986	25084
	COD	MG/L	750	41	95	40	41067	9813	9960
	OIL & GREASE	MG/L	32	12	63	8	5337	1623	270
NON-CONV.	TOTAL PHENOLS	UG/L	85	50	41	21	194	127	118
	TOTAL SOLIDS	MG/L	1163	757	36	812	58947	8827	8499
	TOTAL DISS. SOLIDS	MG/L	798	741	7	794	NOT RUN	NOT RUN	NOT RUN
	SETTLEABLE SOLIDS	ML/L	26	L 1	96	L 1	998	983	870
	TOTAL VOLATILE SOLIDS	MG/L	415	100	76	119	35750	6011	6089
	VOLATILE DISS. SOLIDS	MG/L	88	92		101	NOT RUN	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	MG/L	256	7	97	2	43750	10208	16167
	AMMONIA NITROGEN	MG/L	16	13	28	1	70	27	8
	TOC	MG/L	98	16	84	14	1304	583	335
VOLATILES	BENZENE	UG/L	2	L 1	50	L 1	11	N-D	N-D
	CARBON TETRACHLORIDE	UG/L	1	L 1		L 1	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	UG/L	32	1	97	L 1	N-D	N-D	N-D
	1,1-DICHLOROETHANE	UG/L	3	L 1	67	L 1	N-D	N-D	N-D
	CHLOROFORM	UG/L	5	2	60	24	N-D	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	UG/L	2	L 1	50	L 1	507	N-D	N-D
	ETHYLBENZENE	UG/L	5	L 1	80	L 1	61	N-D	N-D
	METHYLENE CHLORIDE	UG/L	51	14	73	2	N-D	N-D	N-D
	METHYL CHLORIDE	UG/L	5	L 25		L 25	N-D	N-D	N-D
	METHYL BROMIDE	UG/L	37	L 20	46	L 20	N-D	N-D	N-D
	BROMOFORM	UG/L	L 1	L 1		2	N-D	N-D	N-D
	DICHLOROBROMOMETHANE	UG/L	L 1	1		19	N-D	N-D	N-D
	DICHLORODIFLUOROMETHANE	UG/L	40	19	52	17	N-D	N-D	N-D
	CHLORODIBROMOMETHANE	UG/L	0	1		14	N-D	N-D	N-D
	TETRACHLOROETHYLENE	UG/L	15	1	93	L 1	N-D	N-D	N-D
	TOLUENE	UG/L	23	L 1	96	L 1	197	53	125
	TRICHLOROETHYLENE	UG/L	31	0	100	L 1	309	N-D	N-D
	VINYL CHLORIDE	UG/L	13	L 20		L 20	N-D	N-D	N-D
ACIDS.	2,4,6-TRICHLOROPHENOL	UG/L	1	1		L 1	N-D	N-D	N-D
	2,4-DICHLOROPHENOL	UG/L	0	0		L 1	N-D	N-D	N-D
	2,4-DIMETHYLPHENOL	UG/L	0	L 1		L 1	N-D	N-D	N-D
	PHENOL	UG/L	9	0	100	L 1	53	60	23
BASE-NEUT.	1,2,4-TRICHLOROBENZENE	UG/L	14	L 5	64	L 5	308	7	N-D
	1,2-DICHLOROBENZENE	UG/L	L 5	L 5		L 5	88	N-D	N-D

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 20

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	TERTIARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE	NITRIFICATION SLUDGE
BASE-NEUT.	FLUORANTHENE	UG/L	L 4	L 4		L 4	10	N-D	365
	ISOPHORONE	UG/L	6	L 10		L 10	N-D	N-D	N-D
	NAPHTHALENE	UG/L	L 3	L 3		L 3	N-D	N-D	170
	BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	24	6	75	9	2357	671	425
	BUTYL BENZYL PHTHALATE	UG/L	6	L 3	63	L 3	827	N-D	N-D
	DI-N-BUTYL PHTHALATE	UG/L	3	L 4		L 4	200	N-D	N-D
	DIETHYL PHTHALATE	UG/L	3	L 5		L 5	12	8	54
	1,2-BENZANTHRACENE	UG/L	L 5	L 5		L 5	N-D	N-D	70
	11,12-BENZOFLUORANTHENE	UG/L	L 5	L 5		L 5	N-D	N-D	20
	CHRYSENE	UG/L	L 5	L 5		L 5	N-D	N-D	70
	ACENAPHTHYLENE	UG/L	L 10	L 10		L 10	N-D	N-D	305
	ANTHRACENE	UG/L	L 5	L 5		L 5	37	3	700
	1,12-BENZOPERYLENE	UG/L	L 25	L 25		L 25	N-D	N-D	65
	FLUORENE	UG/L	L 5	L 15		L 5	N-D	N-D	250
	PHENANTHRENE	UG/L	L 5	L 5		L 5	37	3	700
	PYRENE	UG/L	L 4	L 4		L 4	10	N-D	310
PESTICIDES	4,4'-DDD	NG/L	52	L 300		L 600	N-D	N-D	N-D
	HEPTACHLOR EPOXIDE	NG/L	38	L 100		L 200	N-D	N-D	N-D
	ALPHA-BHC	NG/L	L 50	L 50		22	N-D	N-D	N-D
	GAMMA-BHC	NG/L	173	72	58	125	N-D	N-D	N-D
METALS	ANTIMONY	UG/L	L 50	L 50		L 50	186	10	L 50
	ARSENIC	UG/L	9	L 50		L 50	258	78	115
	CADMIUM	UG/L	L 2	L 2		L 2	86	46	16
	CHROMIUM	UG/L	39	1	97	L 5	3433	998	1010
	COPPER	UG/L	165	9	95	10	14433	3500	2450
	CYANIDE	UG/L	243	67	64	1565	38050	2917	1650
	LEAD	UG/L	26	L 50		L 50	6467	1420	1600
	MERCURY	NG/L	767	L 200	74	L 200	127852	24167	19500
	NICKEL	UG/L	63	21	67	14	3200	632	775
	SELENIUM	UG/L	L 50	L 50		L 50	134	L 100	L 100
	SILVER	UG/L	7	L 5	29	L 5	773	247	165
	ZINC	UG/L	370	36	90	38	27617	8750	5950
N-C METALS	ALUMINUM	UG/L	2740	91	97	31	NOT RUN	NOT RUN	NOT RUN
	BARIUM	UG/L	125	44	65	39	NOT RUN	NOT RUN	NOT RUN
	CALCIUM	MG/L	46	43	10	43	NOT RUN	NOT RUN	NOT RUN
	IRON	UG/L	2925	98	97	19	NOT RUN	NOT RUN	NOT RUN
	MAGNESIUM	MG/L	26	24	8	24	NOT RUN	NOT RUN	NOT RUN
	MANGANESE	UG/L	81	60	26	4	NOT RUN	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

SUMMARY OF ANALYTICAL DATA

PLANT 20

FRACTION	PARAMETER	UNITS	INFLUENT	SECONDARY EFFLUENT	PCNT REM.	TERTIARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE	NITRIFICATION SLUDGE
N-C METALS	SODIUM	MG/L	132	135		139	NOT RUN	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NEVER DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 20

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
CONVENTIONALS	BOD	245461	229951	21200	69899	138852
	TOTAL SUSP. SOLIDS	417880	625427	13250	299477	312700
	COD	745327	402375	40413	181305	180657
	OIL & GREASE	31635	69218	12091	23561	33566
NON-CONVENTIONALS	TOTAL PHENOLS	84.3	52.9	49.7	.9	2.3
	TOTAL SOLIDS	1175960	1175027	752283	260245	162499
	TOTAL DISS. SOLIDS	792862	-	736217	NOT RUN	NOT RUN
	TOTAL VOLATILE SOLIDS	411917	367708	99211	157833	110664
	VOLATILE DISS. SOLIDS	87286	-	91592	NOT RUN	NOT RUN
	TOTAL VOL. SUS. SOLIDS	254239	388033	6956	193152	187925
	AMMONIA NITROGEN	18053	13234	12422	309	503
	TOC	96892	31884	15403	5758	10723
VOLATILES	BENZENE	2.0	L 0.1	N-D	L 0.1	N-D
	CARBON TETRACHLORIDE	1.3	N-D	N-D	N-D	N-D
	1,1,1-TRICHLOROETHANE	31.6	.7	.7	N-D	N-D
	1,1-DICHLOROETHANE	3.0	N-D	N-D	N-D	N-D
	CHLOROFORM	4.6	2.2	2.2	N-D	N-D
	1,2-TRANS-DICHLOROETHYLENE	2.0	2.2	N-D	2.2	N-D
	ETHYLBENZENE	4.8	.3	N-D	.3	N-D
	METHYLENE CHLORIDE	50.7	13.7	13.7	N-D	N-D
	METHYL CHLORIDE	4.6	N-D	N-D	N-D	N-D
	METHYL BROMIDE	36.0	N-D	N-D	N-D	N-D
	DICHLOROBROMOMETHANE	N-D	1.2	1.2	N-D	N-D
	DICHLORODIFLUOROMETHANE	39.9	19.2	19.2	N-D	N-D
	CHLORODIBROMOMETHANE	.2	.7	.7	N-D	N-D
	TETRACHLOROETHYLENE	15.2	1.2	1.2	N-D	N-D
	TOLUENE	22.9	1.9	N-D	.9	1.0
	TRICHLOROETHYLENE	30.3	1.7	.3	1.4	N-D
	VINYL CHLORIDE	13.3	N-D	N-D	N-D	N-D
ACID EXTRACT	2,4,6-TRICHLOROPHENOL	.7	.5	.5	N-D	N-D
	2,4-DICHLOROPHENOL	.2	.2	.2	N-D	N-D
	2,4-DIMETHYLPHENOL	.2	N-D	N-D	N-D	N-D
	PHENOL	8.9	1.5	.2	.2	1.1
BASE-NEUTRALS	1,2,4-TRICHLOROBENZENE	13.7	1.5	N-D	1.4	.1
	1,2-DICHLOROBENZENE	N-D	.4	N-D	.4	N-D
	FLUORANTHENE	N-D	L 0.1	N-D	L 0.1	N-D
	ISOPHORONE	5.8	N-D	N-D	N-D	N-D
	BIS(2-ETHYLHEXYL) PHTHALATE	23.9	28.4	5.6	10.4	12.4
	BUTYL BENZYL PHTHALATE	8.1	3.6	N-D	3.6	N-D
	DI-N-BUTYL PHTHALATE	2.7	.9	N-D	.9	N-D
	DIETHYL PHTHALATE	2.7	.3	N-D	L 0.1	.2
	ANTHRACENE	N-D	.2	N-D	.2	L 0.1
	PHENANTHRENE	N-D	.2	N-D	.2	L 0.1
	PYRENE	N-D	L 0.1	N-D	L 0.1	N-D
PESTICIDES	4,4'-DDD	L 0.1	N-D	N-D	N-D	N-D
	HEPTACHLOR EPOXIDE	L 0.1	N-D	N-D	N-D	N-D
	GAMMA-BHC	.2	L 0.1	L 0.1	N-D	N-D

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY

PLANT 20

FRACTION	PARAMETER	INFLUENT	TOTAL OUT	SECONDARY EFFLUENT	PRIMARY SLUDGE	SECONDARY SLUDGE
METALS	ANTIMONY	N-D	1.0	N-D	.8	.2
	ARSENIC	9.3	2.5	N-D	1.1	1.4
	CADMIUM	N-D	1.2	N-D	.4	.8
	CHROMIUM	38.4	34.9	1.3	15.2	18.4
	COPPER	184	137	9.3	63.7	64.4
	CYANIDE	241	308	86.3	168	53.7
	LEAD	26.2	54.6	N-D	28.5	26.1
	MERCURY	.8	1.0	N-D	.6	.4
	NICKEL	62.1	49.9	20.5	14.1	15.3
	SELENIUM	N-D	.6	N-D	.6	N-D
	SILVER	7.0	7.9	N-D	3.4	4.5
	ZINC	368	319	35.6	122	161
NON-CONV. METALS	ALUMINUM	2723	-	90.4	NOT RUN	NOT RUN
	BARIUM	124	-	43.4	NOT RUN	NOT RUN
	CALCIUM	47370	-	42235	NOT RUN	NOT RUN
	IRON	2907	-	97.2	NOT RUN	NOT RUN
	MAGNESIUM	25672	-	23519	NOT RUN	NOT RUN
	MANGANESE	80.5	-	60.0	NOT RUN	NOT RUN
	SODIUM	130846	-	134324	NOT RUN	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

MASS BALANCE IN LBS. PER DAY
TERIARY TREATMENT SYSTEM

PLANT 20

FRACTION	PARAMETER	SECONDARY EFFLUENT	TOTAL OUT	TERTIARY EFFLUENT	NITRIFICATION SLUDGE
CONVENTIONALS	BOD	20383	23105	7803	15302
	TOTAL SUSP. SOLIDS	12739	50268	4300	45968
	COD	38855	56471	38218	18253
	OIL & GREASE	11625	7820	7325	495
NON-CONVENTIONALS	TOTAL PHENOLS	47.8	19.9	19.7	.2
	TOTAL SOLIDS	723276	791242	775667	15575
	TOTAL DISS. SOLIDS	707830	-	758310	NOT RUN
	TOTAL VOLATILE SOLIDS	95386	124539	113380	11159
	VOLATILE DISS. SOLIDS	88061	-	96660	NOT RUN
	TOTAL VOL. SUS. SOLIDS	6688	31539	1911	29628
	AMMONIA NITROGEN	11943	493	478	14.7
	TOC	14809	13513	12899	614
VOLATILES	1,1,1-TRICHLOROETHANE	.6	N-D	N-D	N-D
	CHLOROFORM	2.1	22.8	22.8	N-D
	METHYLENE CHLORIDE	13.2	2.2	2.2	N-D
	BROMOFORM	N-D	1.4	1.4	N-D
	DICHLOROBROMOMETHANE	1.1	17.8	17.8	N-D
	DICHLORODIFLUOROMETHANE	18.5	16.6	16.6	N-D
	CHLORODIBROMOMETHANE	.6	13.5	13.5	N-D
	TETRACHLOROETHYLENE	1.1	N-D	N-D	N-D
	TOLUENE	N-D	.2	N-D	.2
	TRICHLOROETHYLENE	.3	N-D	N-D	N-D
ACID EXTRACT	2,4,6-TRICHLOROPHENOL	.5	N-D	N-D	N-D
	2,4-DICHLOROPHENOL	.2	N-D	N-D	N-D
	PHENOL	.2	L 0.1	N-D	L 0.1
BASE-NEUTRALS	FLUORANTHENE	N-D	.7	N-D	.7
	NAPHTHALENE	N-D	.3	N-D	.3
	BIS(2-ETHYLHEXYL) PHTHALATE	5.4	8.9	8.1	.8
	DIETHYL PHTHALATE	N-D	L 0.1	N-D	L 0.1
	1,2-BENZANTHRACENE	N-D	.1	N-D	.1
	11,12-BENZOFLUORANTHENE	N-D	L 0.1	N-D	L 0.1
	CHRYSENE	N-D	.1	N-D	.1
	ACENAPHTHYLENE	N-D	.6	N-D	.6
	ANTHRACENE	N-D	1.3	N-D	1.3
	1,12-BENZOPERYLENE	N-D	.1	N-D	.1
	FLUORENE	N-D	.5	N-D	.5
	PHENANTHRENE	N-D	1.3	N-D	1.3
	PYRENE	N-D	.6	N-D	.6
PESTICIDES	ALPHA-BHC	N-D	L 0.1	L 0.1	N-D
	GAMMA-BHC	L 0.1	.1	.1	N-D
METALS	ARSENIC	N-D	.2	N-D	.2
	CADMIUM	N-D	L 0.1	N-D	L 0.1
	CHROMIUM	1.3	1.9	N-D	1.9
	COPPER	8.9	14.1	9.6	4.5
	CYANIDE	83.0	1498	1495	3.0

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED
E

MASS BALANCE IN LBS. PER DAY
TERIARY TREATMENT SYSTEM

PLANT 20

FRACTION	PARAMETER	SECONDARY EFFLUENT	TOTAL OUT	TERTIARY EFFLUENT	NITRIFICATION SLUDGE
METALS	LEAD	N-D	2.9	N-D	2.9
	MERCURY	N-D	L 0.1	N-D	L 0.1
	NICKEL	19.7	14.8	13.4	1.4
	SILVER	N-D	.3	N-D	.3
	ZINC	34.2	47.5	36.6	10.9
NON-CONV. METALS	ALUMINUM	86.9	-	29.8	NOT RUN
	BARIUM	41.7	-	37.1	NOT RUN
	CALCIUM	40607	-	40925	NOT RUN
	IRON	93.5	-	18.5	NOT RUN
	MAGNESIUM	22612	-	23090	NOT RUN
	MANGANESE	57.6	-	3.8	NOT RUN
	SODIUM	129145	-	132808	NOT RUN

POLLUTANTS NOT LISTED WERE NOT DETECTED
L-LESS THAN; N-D NOT DETECTED;
PRELIMINARY DATA ONLY---TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 20

PARAMETER	INFL-UENT	PRE CL. INFL.	TERT. EFFL.	PRIM. SLDG	SEC. SLDG	NIT. SLDG.
CHLOROFORM	100 (6)	100 (6)	100 (6)	0 (6)	0 (6)	0 (2)
METHYLENE CHLORIDE	100 (6)	100 (6)	100 (6)	0 (6)	0 (6)	0 (2)
COPPER	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (2)
CYANIDE	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (2)
ZINC	100 (6)	100 (6)	100 (6)	100 (6)	100 (6)	100 (2)
DICHLOROBROMOMETHANE	83 (6)	0 (6)	100 (6)	0 (6)	0 (6)	0 (2)
TETRACHLOROETHYLENE	83 (6)	100 (6)	0 (6)	0 (6)	0 (6)	0 (2)
NICKEL	83 (6)	100 (6)	67 (6)	100 (6)	100 (6)	100 (2)
CHLORODIBROMOMETHANE	67 (6)	17 (6)	83 (6)	0 (6)	0 (6)	0 (2)
BIS(2-ETHYLHEXYL) PHTHALATE	67 (6)	100 (6)	83 (6)	100 (6)	100 (6)	100 (2)
GAMMA-BHC	67 (6)	100 (6)	83 (6)	0 (6)	0 (6)	0 (2)
2,4,6-TRICHLOROPHENOL	50 (6)	67 (6)	0 (6)	0 (6)	0 (6)	0 (2)
1,1,1-TRICHLOROETHANE	33 (6)	100 (6)	0 (6)	0 (6)	0 (6)	0 (2)
DICHLORODIFLUOROMETHANE	33 (6)	67 (6)	33 (6)	0 (6)	0 (6)	0 (2)
TRICHLOROETHYLENE	33 (6)	100 (6)	0 (6)	33 (6)	0 (6)	0 (2)
2,4-DICHLOROPHENOL	17 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
PHENOL	17 (6)	67 (6)	0 (6)	33 (6)	33 (6)	50 (2)
CHROMIUM	17 (6)	100 (6)	0 (6)	100 (6)	100 (6)	100 (2)
BENZENE	0 (6)	67 (6)	0 (6)	83 (6)	0 (6)	0 (2)
CARBON TETRACHLORIDE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (2)
1,1-DICHLOROETHANE	0 (6)	83 (6)	0 (6)	0 (6)	0 (6)	0 (2)
1,2-TRANS-DICHLOROETHYLENE	0 (6)	83 (6)	0 (6)	83 (6)	0 (6)	0 (2)
ETHYLBENZENE	0 (6)	100 (6)	0 (6)	100 (6)	0 (6)	0 (2)
METHYL CHLORIDE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
METHYL BROMIDE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (2)
BROMOFORM	0 (6)	0 (6)	67 (6)	0 (6)	0 (6)	0 (2)
TOLUENE	0 (6)	100 (6)	0 (6)	100 (6)	100 (6)	100 (2)
VINYL CHLORIDE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
2,4-DIMETHYLPHENOL	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
1,2,4-TRICHLOROBENZENE	0 (6)	67 (6)	0 (6)	50 (6)	17 (6)	0 (2)
1,2-DICHLOROBENZENE	0 (6)	0 (6)	0 (6)	33 (6)	0 (6)	0 (2)
FLUORANTHENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	50 (2)
ISOPHORONE	0 (6)	33 (6)	0 (6)	0 (6)	0 (6)	0 (2)
NAPHTHALENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
BUTYL BENZYL PHTHALATE	0 (6)	83 (6)	0 (5)	100 (6)	0 (6)	0 (2)
DI-N-BUTYL PHTHALATE	0 (6)	50 (6)	0 (6)	100 (6)	0 (6)	0 (2)
DIETHYL PHTHALATE	0 (6)	50 (6)	0 (6)	17 (6)	17 (6)	50 (2)
1,2-BENZANTHRACENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
11,12-BENZOFLUORANTHENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
CHRYSENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
ACENAPHTHYLENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
ANTHRACENE	0 (6)	0 (6)	0 (6)	33 (6)	17 (6)	50 (2)
1,12-BENZOPERYLENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
FLUORENE	0 (6)	0 (6)	0 (6)	0 (6)	0 (6)	50 (2)
PHENANTHRENE	0 (6)	0 (6)	0 (6)	33 (6)	17 (6)	50 (2)
PYRENE	0 (6)	0 (6)	0 (6)	17 (6)	0 (6)	50 (2)
4,4'-DDD	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
HEPTACHLOR EPOXIDE	0 (6)	17 (6)	0 (6)	0 (6)	0 (6)	0 (2)
ALPHA-BHC	0 (6)	0 (6)	17 (6)	0 (6)	0 (6)	0 (2)
ANTIMONY	0 (6)	0 (6)	0 (6)	100 (5)	20 (5)	0 (1)
ARSENIC	0 (6)	17 (6)	0 (6)	100 (6)	100 (6)	100 (2)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

PERCENT OCCURRENCE OF POLLUTANT PARAMETERS

PLANT 20

PARAMETER	INFLUENT	PRE CL. INFL.	TERT. EFFL.	PRIM. SLDG	SEC. SLDG	NIT. SLDG.
CADMIUM	0 (6)	0 (6)	0 (6)	100 (6)	100 (6)	100 (2)
LEAD	0 (6)	33 (6)	0 (6)	100 (6)	100 (6)	100 (2)
MERCURY	0 (6)	100 (6)	0 (6)	100 (6)	100 (6)	100 (2)
SELENIUM	0 (6)	0 (6)	0 (6)	100 (5)	0 (5)	0 (1)
SILVER	0 (6)	67 (6)	0 (6)	100 (6)	100 (6)	100 (2)

POLLUTANTS NOT LISTED WERE NOT DETECTED AT ANY SAMPLE POINT
UNCONFIRMED PESTICIDES WERE ASSUMED NOT DETECTED
NUMBERS IN PARENTHESES ARE THE NUMBER OF SAMPLES TAKEN
PRELIMINARY DATA ONLY-TO BE VERIFIED

• U.S. GOVERNMENT PRINTING OFFICE: 1981 -757-064/0217

SECTION II

Sludge Analytical Protocol

1.0 METHOD FOR PURGEABLE ORGANICS

1.1 Scope and Application

1.1.1 Scope

This method is used for the determination of purgeable (volatile) organics. The complete list of compounds is provided in Table 1.1. The method is complementary to liquid/liquid extraction techniques for extractable organics.

1.1.2 Application

The method is applicable to the measurement of purgeable organics in municipal wastewater sludges. It can be used for screening samples of sludges for purgeable priority organics in surveys of municipal wastewater treatment plants. The method uses GC/MS systems for qualitative and semi-quantitative determination of these compounds.

1.2 Summary

Sludge samples are diluted to 0.5% total solids content with organic-free water. The diluted sample is then purged at room temperature (~ 22°C) with an inert gas for 12 min. Water insoluble compounds boiling below 200°C are transferred from the aqueous phase to the gaseous phase. The gaseous phase is passed through a sorbent trap where the organic compounds are concentrated. The contents of the trap are then injected into the GC/MS by heating and backflushing the trap. As variations in recovery efficiencies for the individual purgeable organics can be affected by the sample matrices, extensive quality control is required for accurate measurements. The total analysis time including extraction is less than 1 hr. This method is recommended for use only by analysts experienced in the analysis of purgeable organics at the trace levels or by experienced technicians under the close supervision of a qualified analyst.

1.3 Apparatus and Reagents

1.3.1 For Sample Preparation

1.3.1.1 Purge and trap system: Assemble the system as depicted in Figures 1.1 and 1.2. A commercial version, such as the Tekmar Liquid Sample Concentrator Model LSC-1, or its equivalent, may also be used. The purging device is constructed or modified as shown in Figure 1.3. All sample contacting surfaces must be either glass or Teflon. The trap is packed according to Figure 1.4. In order to function properly, the trap must be packed in the following order: Place the glass wool plug in the inlet end of the trap, follow with the OV-1, Tenax, silica gel, charcoal, and finally, the second glass wool plug. Reversing the packing order, i.e., placing the charcoal in the trap first will cause the silica gel and Tenax layers to become contaminated with charcoal dust causing poor desorption efficiencies. Install the trap so that the effluent from the purging device enters the Tenax end of the trap.

1.3.1.2 Glassware

a. Screw-cap vials - 40 ml with Teflon-lined caps

b. 10 ml, 50 ml, and 100 ml volumetric flasks

1.3.1.3 Analytical balance

1.3.1.4 Roller mill and 1/4 in. stainless steel ball bearings

1.3.1.5 Catalytic gas purifier

1.3.1.6 Purging gas - He or N_2, water compressed, high-purity grade

1.3.1.7 Syringes - 10 µl, 100 1, 1 ml and 5 ml gas-tight.for quality control spiking. A large bore 10-ml syringe is used for sample handling. A 20-ml gas-tight syringe is used for preparing standards of neat gaseous compounds.

1.3.1.8 Purgeable - organics-free water. See Section 1.5

a. Activated Carbon-Calgon Filtrasorb-200 or equivalent

1.3.1.9 Trap Packing Materials

a. 3% OV-1 on Chromosorb-W 100/110 mesh

b. Tenax-GC® - 60/80 mesh

c. Silica gel - Davison Grade 15 35/60 mesh or equivalent

d. Coconut charcoal - 26 mesh Barnaby Chaney No. CA-580-26, Lot No. M-2649 or equivalent, as used in NIOSH charcoal adsorption tubes, available through Supelco, Inc. (Cat. No. 2-0267).

1.3.1.10 Glass wool - Cleaned by thorough rinsing with hexane, dried in a 110°C oven, and stored in a hexane-rinsed glass jar with TFE -lined cap.

1.3.2 For Quantitation and Identification

1.3.2.1 Gas Chromatograph-mass spectrometer data system. Finnigan 4000 or equivalent - The GC/MS interface should be a glass jet separator. The computer system should allow acquisition and storage of repetitive scan data throughout the GC/MS runs. Computer software should be available to allow searching of GC/MS data for display of extracted ion current profiles (EICP) and integration of the peaks. The GC/MS should be fitted with a stainless steel or glass column packed with 0.2% Carbowax 1500 or Carbopack C. Typical column dimensions are 8 ft x 1/8 in. OD stainless steel or 6 ft x 2 mm ID glass.

1.3.2.2 Reference materials - Assayed quantity of compounds of interest, and/or diluted standard solutions of compounds of interest and internal standard compounds in methanol.

1.3.2.3 Mass spectrometer calibration compound - p-fluorobromobenzene.

1.4 Sampling and Preservation

1.4.1 Sampling

Samples must be collected in 40-ml screw-cap vials with zero head space and sealed with Teflon-lined caps. Before using, wash all sample bottles and TFE seals in detergent, rinse with tap water and finally with distilled water. Allow the bottles and seals to air dry at room temperature, heat in a 105°C oven for 1 hr, then allow to cool in an area known to be free of organics. NOTE: Do not heat the TFE seals for extended periods of time (more than 1 hr) because the silicone layer slowly degrades at 105°C.

1.4.2 Preservation

As a general guideline, ice samples immediately after collection, refrigerate at 4°C, and purge within 10 days. Desorb the trap and complete the analyses immediately after purging.

1.4.3 Solids Determination

The total solids content of the sample is determined in duplicate by weighing two ∿ 1 ml aliquots of the extractable sludge sample before and after drying overnight at 110°C. The general procedure outlined in Standard Methods for the Examination of Water and Wastewater, 14th ed., for the determination of Total Dried Residue (Part 208A) at 103 to 105°C is applicable.

1.5 Preparation of Purgeable Organic-Free Water

Organic-free water is generated by passing tap water through a carbon filter bed containing about 1 lb of activated carbon and purged with prepurified N_2, preferably overnight. A Millipore Super-Q Water System or its equivalent may be used to generate organic-free deionized water. Organic-free water can also be prepared by boiling distilled water for 15 min and transferring, while still hot, to a glass-stoppered bottle.

Cool to room temperature. Continuous purging of the organic-free water with pre-purified N_2 may be used during storage to minimize contamination with volatile organic compounds. Test organic-free water daily by analyzing according to this method (see Section 1.9).

1.6 Preparation of Standards

1.6.1 Analytical Standards

Although this protocol assumes the preparation of standard solutions from assayed reference materials, commercially prepared stock solutions, such as Supelco, Inc., Purgeable Standards, may be used for analytical and fortification standards with appropriate dilution.

1.6.1.1 Preparation from neat compounds - From individual assayed reference materials prepare standard stock solutions (at approximately 2 μg/μl) by adding, from a 100-μl syringe, 1 to 2 drops of the 99+% pure reference standard to methanol (9.8 ml) contained in a tared 10-ml volumetric flask (weighed to the nearest 0.1 mg). Add the component so that the two drops fall into the alcohol and do not contact the neck of the flask. (Prepare gaseous standards, i.e., vinyl chloride) in a similar manner using a 20-ml syringe (20 ml) with the gaseous compound. Weight the 10-ml volumetric flask containing 9.8 ml of methyl alcohol to 0.1 mg. Lower the syringe needle to about 5 mm above the methyl alcohol meniscus and slowly inject the standard into the flask. The gas rapidly dissolves in the methyl alcohol. Reweigh the flask, and use the weight gain to calculate the concentration of the standard. Dilute to volume, mix, and store in the sealed flask. Gas stock standards are generally stable for at least 1 week when maintained at less than 0°C. With the exception of 2-chloroethylvinylether, stock standards of compounds that boil above room temperature are generally stable for at least 4 weeks when stored at 4°C. (Safety Caution: Because of the toxicity of most organohalides, dilutions should be made in a glove box suitable for handling carcinogens. It is advisable to use an approved respirator when high concentrations of such materials must be handled in a fume hood).

From the primary stock solutions, prepare a multicomponent secondary dilution mixture in methyl alcohol at a concentration of 1 μg/ml containing each of the compounds to be determined. Assuming storage at 4°C, prepare a fresh multicomponent secondary dilution mixture on a weekly basis. Daily prepare 10 ml of a 50 ng/ml standard from the 1 μg/ml multicomponent standard by dosing 500 μl into ∿ 9 ml of organic-free water, and adjusting the volume to 10.0 ml. Analyze 1 ml and 5 ml aliquots of the aqueous standard

Stock solutions, as received are stored in a freezer when not in use. To prepare a working standard, 25 µl of both Purgeable Standard A and Purgeable Standard B are added to ~ 99 ml of organic-free water. Subsequently, 100 µl of Purgeable Standard C and 50 µl of the acrolein/acrylonitrile standard are added and the final volume adjusted to 100 ml. Final concentrations for Purgeable A and B compounds are 50 ng/ml. Final concentrations of Purgeable C compounds are 200 ng/ml, and acrolein/acrylonitrile are present at 500 ng/ml in the standard. Analyses of 1 ml and 5 ml of this mixed standard (after volume adjustments to 10 ml with organic-free water), will produce responses nominally corresponding to 50 µg/liter and 250 µg/liter, or 50 ng and 250 ng, respectively.

Prepare a fresh aqueous working standard on a daily basis.

1.6.2 Internal Standard Spiking Solution

Although this protocol assumes the preparation of the standard solutions from neat authentic compounds, appropriate reliable commercial preparations may be used as suitable substitutes.

1.6.2.1 Preparation from neat compounds - From stock standard solutions prepared as above, add a volume of standard to give 1,000 µg each of bromochloromethane, 2-bromo-1-chloropropane, and 1,4-dichlorobutane to 45 ml of organic-free water (blank water) contained in a 50-ml volumetric flask, mix and dilute to volume. Dose 9.0 ul of this internal standard spiking solution into every sample and reference standard analyzed. Prepare a fresh method recovery spiking solution on a weekly basis. Prepare the stock standard solutions monthly, or sooner if deterioration is indicated.

1.6.2.2 Preparation from commercial mixed stock solution - As an alternate to preparation of the mixed internal standard solution from neat compounds, a commercially prepared stock mixture may be employed. The method outlined below is specifically designed for use with the Supelco, Inc., mixed stock internal standard solution which contains 20 mg/ml of each compound.

1.7 Sample Preparation and Purging

1.7.1 Sample Compositing

VOA samples are collected at discrete time intervals by grab sampling. When VOA results for relatively long time intervals, such as 24 hr, are necessary or desirable, compositing of *several* VOA grab samples must be performed. To do this, normally six VOA grab samples (i.e., one 40-ml grab sample collected every 4 hr over a 24-hr period) will be composited. After storage, sample disruption with a glass stirring rod may be necessary to remove the sample from the VOA vial adequately. Care must be taken to avoid displacement losses when the stirring rod is used. The chilled samples are mixed with gentle swirling in a 250-ml round-bottom flask. Vigorous mixing must be avoided to prevent analyte losses. Analysis should be performed immediately after compositing. In cases where this is impossible or when sample material is to be retained for future reference, aliquots of the composited VOA samples are returned to VOA vials with zero headspace and refrigerated at 4°C. Normally, only four full VOA vials of composited material can be prepared from six individual grab samples.

1.7.2 Sample Preparation and Purging

Condition the trap at 200°C with a flow of nitrogen or helium. Turn off gas flow to the purging device.

Transfer that amount of sludge which contains greater than 50 mg dry solids (i.e., 1 ml for a 5% sludge) to the syringe body. Assemble the syringe body and plunger. Adjust the sludge aliquot to a volume containing 50 mg dry solids. Add internal standard to the adjusted sample aliquot through the syringe outlet. Transfer the sample to the purging device. Rinse the syringe with organic-free water and add to the purging device. Bring the level in the purging device to the 10-ml mark with organic-free water. Prior to purging, place a glass wool plug in the top of the purge tube to dispense excessive foam. Seal the purging device, and turn on the gas flow to the purging device and adjust to a flow rate of approximately 40 ml/min.

Purge the sample for 12 min while maintaining the sample and trap at room temperature.

1.8 Analysis of the Sample Purge

Analyze the sample purge by GC/MS using the 0.2% Carbowax 1500 on 80/100 mesh Carbopack C column described in Section 1.3.2.1 operated with a He carrier gas flow of 30 ml/min. Heat the trap to 180 to 200°C. Backflush it for 3 min into the gas chromatograph with the oven at 40°C. Hold the oven temperature at 40°C for 3 min during the desorption stage. Immediately after desorption initiate temperature programming. For 8-ft stainless steel columns a programming rate of 10°C/min to 170°C should be used. For 6-ft glass columns a program rate of 6°C/min to 170°C is effective. Hold at this temperature until all compounds of interest have eluted. The purging device must be removed from the instrument and thoroughly rinsed with copious volumes of volatile organic-free water between each sample (nominally three rinses of ∿ 30 ml volume per rinse). Thoroughly clean the purging device according to procedures in Section 1.4.1 between particularly dirty samples. The trap must be conditioned at 180°C with flow for 5 to 7 min between each sample. The MS should be repetitively scanned over the range m/e 20 to 275 at 3 to 5 sec/scan.

1.9 Purgeable Organics Analytical Quality Assurance

In addition to the instrumental quality assurance procedures specified in Sections 1.9.1 and 1.9.2, analyses of replicate and fortified samples and blanks are required to indicate the method precision and accuracy. Since the method precision may be very dependent on the sample matrix, the

1.9.4 Fortified and Duplicate Samples

1.9.4.1 Sample Selection

After the analysis of samples collected at the first sampling time, spike and analyze duplicate sample aliquots from the first samples. For example, for a survey program sampling a POTW plant daily for 4 to 6 days, collect triplicate samples for the first day. After completing analyses of one set of the 1st day samples, spike and analyze duplicate 1st day samples. Spike the 1st day samples using procedures described in Section 1.9.4.2. The frequency of selecting spiked duplicate samples for analysis for sampling programs longer than 6 days should be determined from the detention times of the sludge types samples so as to reflect possible changes in sample matrix.

1.9.4.2 Fortification Procedures

Add one or two stainless steel ball bearings (1/8 in. diameter) to an empty vial and determine the tare weight. Fill the vial with sludge and reweigh; the weight difference determines the wet contents of the vial.

Fortify the sample with all of the compounds noted in Table 1.1 to produce a final concentration two times the concentration found in the unspiked sample, or 10 times the lower limit of detection reported in Table A-1, whichever is greater. Generally, blanket fortifications of analytes can be accomplished using commercially available mixed standards; however, for analytes present in unusually high concentrations, supplemental fortification with an individual solution may be required. Seal the vial and place on a roller mill in a 4°C cold room; roll the sample for 16 hr before analysis.

The fortified sample is handled as a regular sample during analysis. The quantity of fortified sample analyzed must be equal the quantity of original unfortified sample analyzed.

1.10 Data Handling

Using the characteristic retention times and ions listed in Tables 1.2 and 1.3, obtain extracted ion current profiles (EICPs) of the characteristic ions for each compound. Verify the presence of compounds of interest based on the coincidences of peaks in the characteristic EICPs at the appropriate retention times with intensities in the characteristic ratios.

Calculate the concentrations of compounds identified by comparing the areas of the primary (highest abundance) ion peaks with the areas of the corresponding standard peaks. If the sample matrix produces a significant interference with the primary ion EICP, a secondary ion plot may be used for quantitation. For some analytes, such as toluene and ethylbenzene, it may be necessary to use ions of substantially lower intensity, e.g., m/e 93 or 107 for quantitative evaluation. Calculate the concentration in the sample as follows:

$$\left(\frac{A}{B}\right)\left(\frac{B_{IS}}{A_{IS}}\right)\left(\frac{N}{V}\right) = \mu g/\text{liter analyte in wet sludge}$$

where: A = area of peak in sample

B = area of peak in standard

A_{IS} = area of internal standard peak in sample

B_{IS} = area of internal standard peak in standard

N = nanograms in standard

V = volume of wet sludge analyzed (ml)

Table 1.0. Stock VOA Standards Available From Supelco

Purgeable A	Purgeable B	Purgeable C
Dichloromethane	Trifluoromethane	Chloromethane
1,1-Dichloroethylene	trans-1,2-Dichloroethylene	Dichlorodifluoromethane
1,1-Dichloroethane	1,2-Dichloroethane	Bromomethane
Chloroform	1,1,1-Trichloroethane	Vinyl chloride
Carbon tetrachloride	Bromodichloromethane	Chloroethane
1,2-Dichloropropane	trans-1,3-Dichloropropene	
Trichloroethylene	cis-1,3-Dichloropropene	
1,1,2-Trichloroethane	Benzene	
Dibromochloromethane	Bromoform	
Tetrachloroethylene	1,1,2,2-Tetrachloroethane	
	Toluene	
	Ethylbenzene	

Table 1.1. Volatile Organics Detectable With the Purge-And-Trap Method

Compound

F/Cl/Br/Methanes

Methylchloride (chloromethane)
Methylene chloride (dichloromethane)
Chloroform (trichloromethane)
Carbon tetrachloride
  (tetrachloromethane)
Methylbromide (bromomethane)
Bromoform (tribromomethane)
Chlorodibromomethane
Bromodichloromethane
Dichlorodifluoromethane
Trichlorofluoromethane

Cl-Ethanes

Chloroethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane

Cl-Benzenes

Benzene
Chlorobenzene
Toluene
Ethylbenzene

Compound

Cl-Ethylenes, Propane

Vinylchloride (chloroethylene)
1,1-Dichloroethylene
  (1,1-dichloroethene)
Trans-1,2-dichloroethylene
(Trans-1,2-dichloroethene)
Trichloroethylene (trichloroethene)
Tetrachloroethylene
  (tetrachloroethene)
1,2-dichloropropane
1,2-dichloropropylene
Trans-1,3-dichloropropene
Cis-1,3-dichloropene

Alkenes

Acrolein (propenal)
Acrylonitrile (propene nitrile)

Ethers

Bis-chloromethylether*
  (sym.-dichlorodimethylether)
2-Chloroethylvinylether
  (2-chloroethyl ethenylether)
Bis-(2-chloroethyl) ether
  (β,β'-dichlorodiethylether)
Bis-(2-chloroisopropyl) ether
  (β,β'-dichlorodisopropyl ether)

---

* Bis-Chloromethylether has a half-life of about 10 seconds in aqueous mixtures.

Table 1.2. Elution Order of Volatile Priority Pollutants[a/]

Compound	RRT[b/]
Chloromethane	0.152
Dichlorodifluoromethane	0.172
Bromomethane	0.181
Vinyl Chloride	0.186
Chloroethane	0.204
Methylene Chloride	0.292
Trichlorofluoromethane	0.372
1,1-Dichloroethylene	0.380
Bromochloromethane (IS)	0.457
1,1-Dichloroethane	0.469
Trans-1,2-dichloroethylene	0.493
Chloroform	0.557
1,2-Dichloroethane	0.600
1,1,1-Trichloroethane	0.672
Carbon Tetrachloride	0.684
Bromodichloromethane	0.750
Bis-chloromethyl ether	0.760
1,2-Dichloropropane	0.818
Trans-1,3-dichloropropene	0.847
Trichloroethylene	0.867
Dibromochloromethane	0.931
Cis-1,3-dichloropropene	0.913
1,1,2-Trichloroethane	0.913
Benzene	0.937
2-Chloroethylvinyl ether	0.992
2-Bromo-1-chloropropane (IS)	1.000
Bromoform	1.115
1,1,2,2-Tetrachloroethene	1.262
1,1,2,2-Tetrachloroethane	1.281
1,4-Dichlorobutane (IS)	1.312
Toluene	1.341
Chlorobenzene	1.489
Ethylbenzene	1.814
Acrolein	Unknown
Acrylonitrile	Unknown

---

a/ These data were obtained under the following conditions: GC column - stainless steel, 8-ft long x 0.1 in. I.D. packed with Carbopack C (60/80 mesh), coated with 0.2% Carbowax 1500; carrier flow - 30 ml/min; oven temperature - initial 60°C held for 3 min, programmed 8°C/min to 160°C and held until all compounds eluted.

b/ Retention times relative to 2-bromo-1-chloropropane with an absolute retention time of 829 sec.

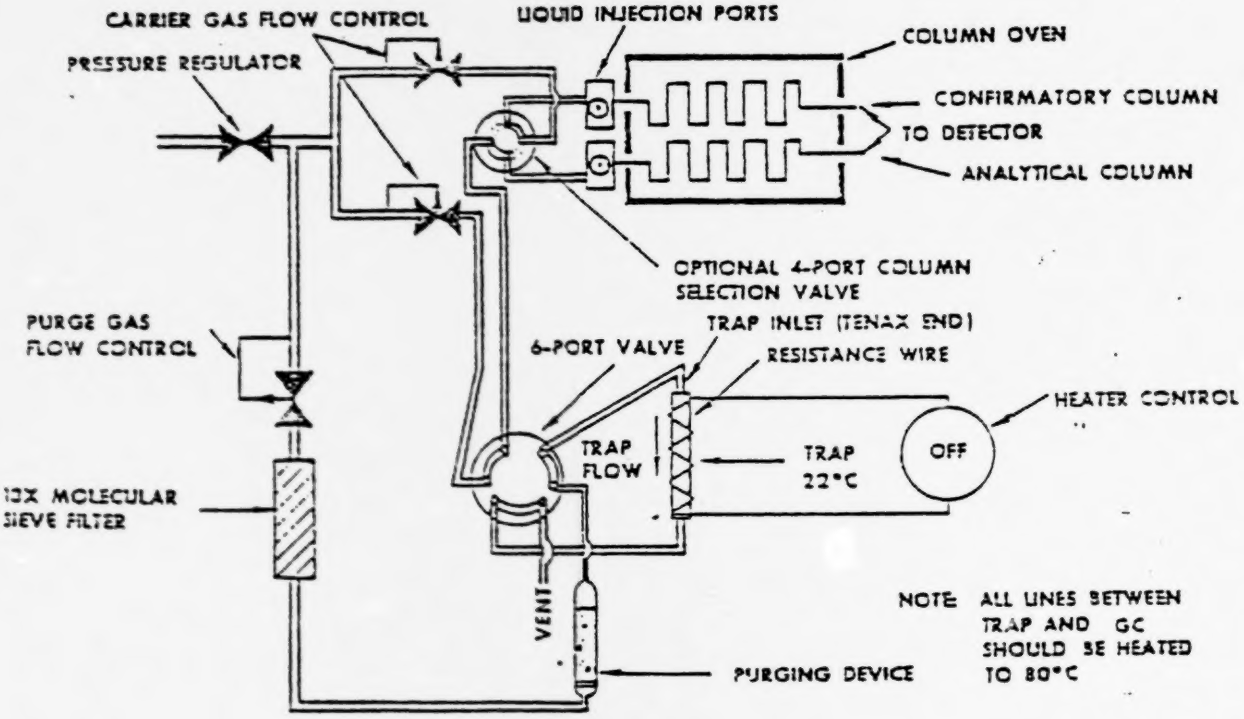

CARRIER GAS FLOW CONTROL
LIQUID INJECTION PORTS
COLUMN OVEN
PRESSURE REGULATOR
CONFIRMATORY COLUMN
TO DETECTOR
ANALYTICAL COLUMN
OPTIONAL 4-PORT COLUMN SELECTION VALVE
PURGE GAS FLOW CONTROL
TRAP INLET (TENAX END)
6-PORT VALVE
RESISTANCE WIRE
HEATER CONTROL
TRAP FLOW
TRAP 22°C
OFF
13X MOLECULAR SIEVE FILTER
VENT
NOTE: ALL LINES BETWEEN TRAP AND GC SHOULD BE HEATED TO 80°C
PURGING DEVICE

Figure 1.1 - Schematic of Purge and Trap Device - Purge Mode

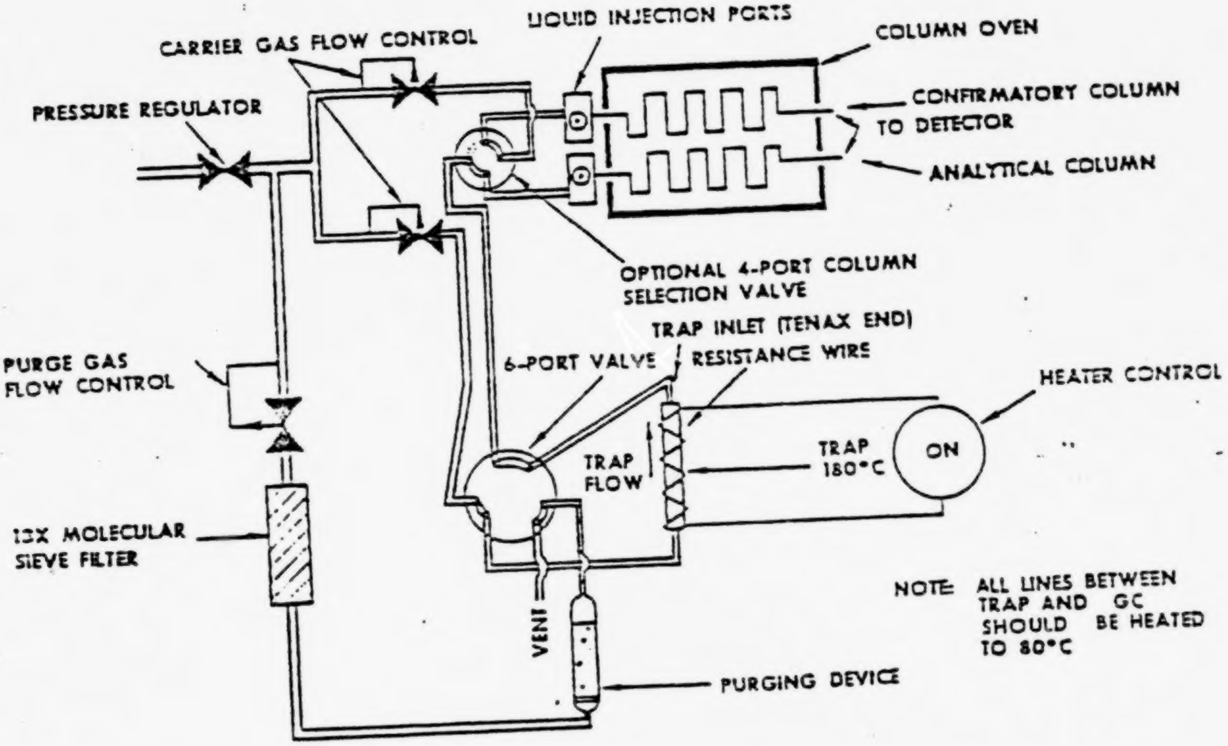

LIQUID INJECTION PORTS
CARRIER GAS FLOW CONTROL
COLUMN OVEN
PRESSURE REGULATOR
CONFIRMATORY COLUMN
TO DETECTOR
ANALYTICAL COLUMN
OPTIONAL 4-PORT COLUMN SELECTION VALVE
TRAP INLET (TENAX END)
6-PORT VALVE
RESISTANCE WIRE
PURGE GAS FLOW CONTROL
HEATER CONTROL
TRAP FLOW
TRAP 180°C
ON
13X MOLECULAR SIEVE FILTER
NOTE: ALL LINES BETWEEN TRAP AND GC SHOULD BE HEATED TO 80°C
VENT
PURGING DEVICE

Figure 1.2 - Schematic of Purge and Trap Device - Desorb Mode

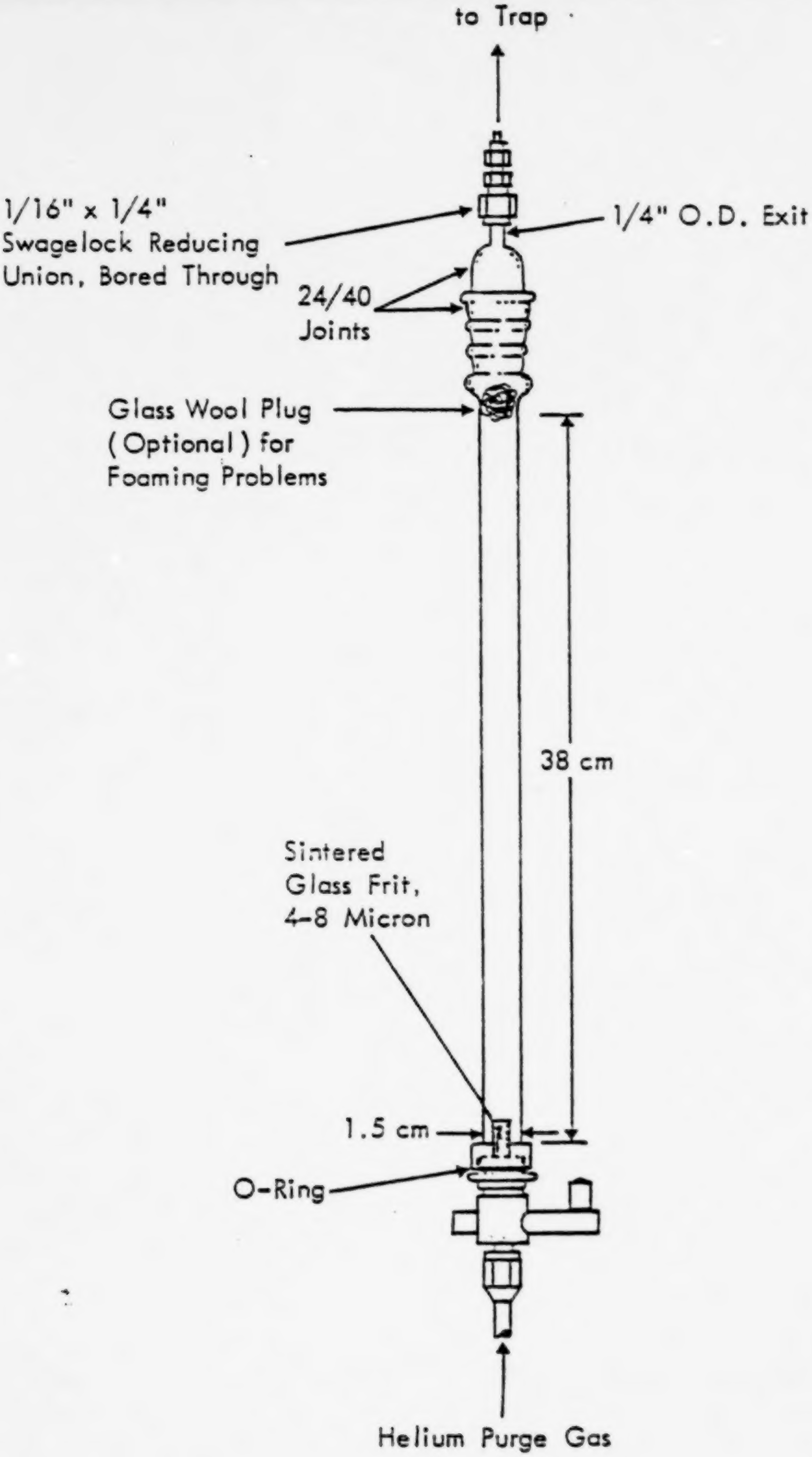
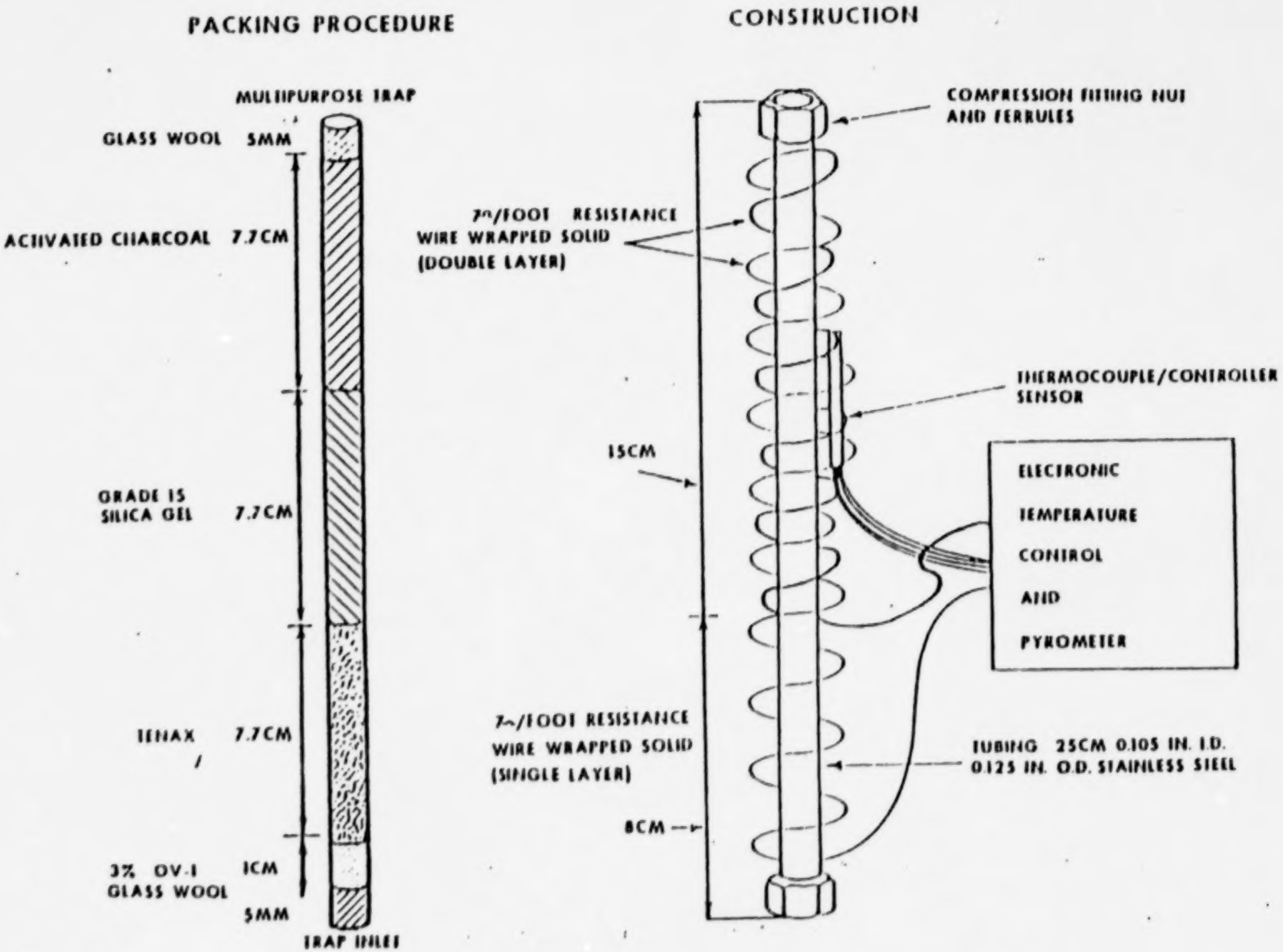

to Trap
1/16" x 1/4" Swagelock Reducing Union, Bored Through
1/4" O.D. Exit
24/40 Joints
Glass Wool Plug (Optional) for Foaming Problems
38 cm
Sintered Glass Frit, 4-8 Micron
1.5 cm
O-Ring
Helium Purge Gas

Figure 1.3 - Sludge Purging Tube

257<



PACKING PROCEDURE
MULTIPURPOSE TRAP
GLASS WOOL 5MM
ACTIVATED CHARCOAL 7.7CM
GRADE 15 SILICA GEL 7.7CM
TENAX 7.7CM
3% OV-1 GLASS WOOL 1CM
5MM
TRAP INLET
CONSTRUCTION
COMPRESSION FITTING NUT AND FERRULES
7Ω/FOOT RESISTANCE WIRE WRAPPED SOLID (DOUBLE LAYER)
THERMOCOUPLE/CONTROLLER SENSOR
15CM
ELECTRONIC TEMPERATURE CONTROL AND PYROMETER
7Ω/FOOT RESISTANCE WIRE WRAPPED SOLID (SINGLE LAYER)
TUBING 25CM 0.105 IN. I.D. 0.125 IN. O.D. STAINLESS STEEL
8CM

Figure 1.4 - Trap Packings and Construction

Table 1.3. Characteristic Ions of Volatile Organics

Compound	EI Ions (Relative Intensity)	Ion Used to Quantify
Chloromethane	50(100); 52(33)	50
Dichlorodifluoromethane	85(100); 87(33); 101(13); 103(9)	101
Bromomethane	94(100); 96(94)	94
Vinyl chloride	62(100); 64(33)	62
Chloroethane	64(100); 66(33)	64
Methylene chloride	49(100); 51(33); 84(86); 86(55)	84
Trichlorofluoromethane	101(100); 103(66)	101
1,1-Dichloroethylene	61(100); 96(80); 98(53)	96
Bromochloromethane (IS)	49(100); 130(88); 128(70); 51(33)	128
1,1-Dichloroethane	63(100); 65(33); 83(13); 85(8); 98(7); 100(4)	63
Trans-1,2-dichloroethylene	64(100); 96(90); 98(57)	96
Chloroform	83(100); 85(66)	83
1,2-Dichloroethane	62(100); 64(33); 98(23); 100(15)	98
1,1,1,-Trichloroethane	98(100); 99(66); 117(17); 119(16)	97
Carbon tetrachloride	117(100); 119(96); 121(30)	117
Bromodichloromethane	83(100); 85(66); 127(13); 129(17)	127
Bis-chloromethyl ether	79(100); 81(33)	79
1,2-Dichloropropane	63(100); 65(33); 112(4); 114(3)	112
Trans-1,3-Dichloropropene	75(100); 77(33)	75
Trichloroethylene	95(100); 97(66); 130(90); 132(85)	130
Dibromochloromethane	129(100); 127(78); 208(13); 206(10)	127
cis-1,3-Dichloropropene	75(100); 77(33)	75
1,1,2-Trichloroethane	83(95); 85(60); 97(100); 99(63); 132(9); 134(8)	97
Benzene	78(100)	78
2-Chloroethylvinyl ether	63(95); 65(32); 106(18)	106
2-Bromo-1-chloropropane (IS)	77(100); 79(33); 156(5)	77
Bromoform	171(50); 173(100); 175(50); 250(4); 252(11); 254(11); 256(4)	173
1,1,2,2-Tetrachloroethene	129(64); 131(62); 164(78); 166(100)	164
1,1,2,2-Tetrachloroethane	83(100); 85(66); 131(7); 133(7); 166(5); 168(6)	168
1,4-dichlorobutane (IS)	55(100); 90(30); 92(10)	55
Toluene	91(100); 92(78)	92
Chlorobenzene	112(100); 114(33)	112
Ethylbenzene	91(100); 106(33)	106
Acrolein	26(49); 27(100); 55(64); 56(83)	56
Acrylonitrile	26(100); 51(32); 52(75); 53(99)	53

Table 1.4. p-Fluorobromobenzene Ions and Ion Abundance Criteria

M/E	Ion Abundance Criteria
50	20-40% of base peak
75	55-75% of base peak
95	base peak
174	75-98% of base peak
175	5-9% of m/e 174
176	75-98% of base peak and 93-99% of m/e 174
177	0-5% of m/e 176

2.0 METHOD FOR SEMIVOLATILE ORGANICS

2.1 Scope and Application

2.1.1 Scope

This method applies to the determination of the base, neutral, and acid-extractable organic compounds as described in Table 2.1.

2.1.2 Application

The method is for the measurement of these compounds in municipal wastewater sludges. It can be used as a qualitative and semiquantitative screening procedure for the analyses of priority toxic organics in surveys of sludges from municipal wastewater treatment plants. As a screening tool, the procedure requires the use of a GC/MS spectrometer as the final detector.

2.2 Summary

2.2.1 This method (Figure 2.1) uses wet sludge/solvent extraction aided by a high-speed homogenizer. The extract is separated by centrifugation and removed with a pipette. Sludges are extracted at pH ≥ 11 and again at pH ≤ 2 to extract base/neutral and acidic compounds, respectively. Both extracts are cleaned by gel permeation chromatography (GPC) and semivolatile organic priority pollutants are determined in the cleaned extracts by GC/MS.

The method is recommended for use only by experienced organic analysts or by competent personnel under the close supervision of an experienced organic analyst.

2.3 Apparatus

2.3.1 For sampling, extraction and extract cleanup.

2.3.1.1 Emulsifier-Tekmar Tissuemizer, or equivalent, high capacity.

2.3.1.2 Centrifuge.

2.3.1.3 Centrifuge tubes with TFE-lined screw caps, 250 ml or larger capacity.

2.3.1.4 Kuderna-Danish (K-D) Glassware -

a. Snyder Columns - 3 bulb, macro and micro

b. Evaporating flasks - 500 ml

c. Receiver Ampuls - 10 ml, graduated, with spring attachment.

2.3.1.5 Water or steam bath for Kuderna-Danish concentrations.

2.3.1.6 Chromatographic (drying) Column - Pyrex (400-mm by 20-mm ID) without a fritted plate.

2.3.1.7 Separatory funnels - 500 ml with teflon stopcock.

2.3.1.8 Syringe - 100 ml, Pyrex, with long needle.

2.3.1.9 Graduated cylinder - 500 ml.

2.3.1.10 Vials - 1 dram (~ 4 ml) with TFE-lined screw caps.

2.3.1.11 Sample bottles - 1,000 ml or 4,000 ml glass with TFE-lined screw caps.

2.3.1.12 GPC - Analytical Biochemistry Labs, Inc. GPC Autoprep 1002 or equivalent with a 25 mm ID column containing 50 to 60 g of BioBeads SX-3.

2.3.1.13 Syringe filter holder - stainless steel and TFE, Gelman 4310, or equivalent.

2.3.1.14 Bottles - 500 ml, brown glass.

2.3.2 For identification and quantitation.

2.3.2.1 Gas chromatograph/mass spectrometer with data system - Finnigan 4000 or equivalent. The GC/MS interface should be a glass jet separator. The computer system should allow acquisition and storage of repetitive scan data throughout the GC/MS runs. Computer software should be available to allow searching of GC/MS data for display of estracted ion current profiles (EICPs) and integration of the peaks. GC columns required are:

a. 1.8 m x 2 mm ID glass packed with 1% SP-2250 on 100/120 mesh Supelcoport.

b. 0.9-1.8 m x 2 mm ID glass packed with 1% SP-1240-DA on 100/120 mesh Supelcoport.

2.3.2.2 Gas chromatograph/flame ionization detection with the same GC columns as for the GC/MS system.

2.3.2.3 Syringes, 10 and 100 µl.

2.3.2.4 Internal standard solution - D-10-anthracene, 2 µg/µl in dichloromethane.

2.4 Reagents

2.4.1 For Extraction and Extract Cleanup

2.4.1.1 Dichloromethane - Burdick and Jackson "Distill in Glass" or equivalent, stored in original containers and used as received.

2.4.1.2 Hydrochloric acid (HCl) - 6 N.

2.4.1.3 Sodium hydroxide (NaOH) - 6 N.

2.4.1.4 Sodium sulfate (Na_2SO_4) - Anhydrous, granular. Clean by overnight Soxhlet extraction with dichloromethane, drying in a 110° oven, and then heating to 650°C for 2 hours. Store in 110°C oven or in glass jar closed with TFE®-lined screw cap.

2.4.1.5 Glass wool - Cleaned by thorough rinsing with hexane, dried in a 110°C oven, and stored in a hexane-rinsed glass jar with TFE®-lined cap.

2.4.1.6 Boiling chips - silica or carborundum.

2.4.1.7 GPC calibration solutions:

a. Corn oil - 200 mg/ml in dichloromethane.

b. bis(2-ethylhexylphthalate) and pentachlorophenol - 4.0 mg/ml in dichloromethane.

2.4.2 Identification and Quantitation

2.4.2.1 Reference Materials - Assayed quantity of compounds of interest (Table 2.1) and/or dilute standard solutions of compounds of interest in appropriate solvents.

2.4.2.2 Calibration Standards - bis-(pentafluorophenyl)phenyl phosphine and D-10-anthracene.

2.5 Preparation of Standards

Primary standard solutions may be prepared from the pure compounds by dissolving 10 mg quantities into 10.0 ml of dichloromethane. Mixed analytical standards may be prepared by diluting the primary solutions. Analytical standards for all semivolatile compounds should be prepared in three solutions. The acids standard should contain each of the phenolic compounds at concentrations in the range of 50 to 200 ng/ul. B/N/P compounds should be split between two solutions, both at concentrations in the range of 20 to 100 ng/ul. One standard should contain the more unstable B/N compounds listed in Table 2.2 and the second should contain the remaining B/N/P compounds. Analytical standards may also be obtained from EPA Effluent Guidelines Division or be prepared by dilution of stock standard solutions purchased from chromatographic materials suppliers such as Supelco, Inc. All working standards must include D-10-anthracene at 20 ng/ul.

2.6 Sampling and Preservation

2.6.1 Sampling

Samples must be collected in glass containers (1,000-4,000 ml) with a TFE-lined cap. The container should be prewashed with acetone and dried before use. Containers should be filled no more than two-thirds full with sample to minimize breakage during freezing.

2.6.2 Preservation

Preferably, samples should be iced or refrigerated at 4°C for not more than 24 hours before extraction. Where extraction cannot be performed within 24 hours, samples should be frozen. Samples may be stored for up to 30 days at -20°C or indefinitely at -75°C. In order to prevent breakage during storage, the containers should not be slightly warmed and then recooled. The iced or defrosted sample should be homogenized by mixing for 1 minute with a tissuemizer before analysis.

2.7 Sample Extraction

2.7.1 Preparation of Drying Column

Immediately prior to extracting a sample, prepare a drying tube for the extract. Place a small glass wool plug in the bottom of the column and add anhydrous sodium sulfate to a depth of 10 to 15 cm.

2.7.2 pH Adjustment

Thoroughly mix the sludge sample by homogenizing in the sample bottle for 1 minute, 4 samples at a time, then quickly remove an 80 ml aliquot into a 100 ml graduated cylinder. Transfer the aliquot into a 250 ml centrifuge tube. Basify the 80 ml portion to pH ≥ 11 with 6 N sodium hydroxide solution. Mix briefly with the homogenizer to insure uniform sample pH.

(Note: If copious precipitation of carbonates is observed when sodium hydroxide is added, make the sample slightly acidic with

6 N hydrochloric acid and allow the carbon dioxide evolution to cease before basifying the sample.)

2.7.3 Extraction

Add 80 ml of dichloromethane to the sample and homogenize for 45 to 60 sec. Do not homogenize more than 60 sec to avoid heating the sample. Centrifuge the samples and extracts at 3,000 rpm for 30 minutes. Repeat centrifugation if satisfactory phase separation is not achieved. The mixture will separate into an aqueous layer over the dichloromethane extract with a solids cake at the water-dichloromethane interface. Withdraw the extract from each centrifuge tube with a 100 ml pipette. Discharge the extracts into a 500 ml separatory funnel. Drain the dichloromethane through the drying column into a Kuderna-Danish evaporator. Retain any aqueous layer and return it in approximately equal volumes to each of the four centrifuge tubes.

Extract the sample two more times (to achieve three-fold extraction) according to procedures described in Sections 2.7.3 and 2.7.4. Wash the drying column with an additional 100 ml of dichloromethane and combine the eluent with the extracts.

2.7.4 Extract Concentration

Add a boiling chip to the extract in the Kuderna-Danish evaporator and concentrate the extract to ∿ 8 ml using a 85°C water bath or a steam bath. If the extract is only slightly colored and not viscous concentrate it further to 5 ml. If the extract solidifies after cooling, dilute it to 8 ml. Transfer the extract to a 10 ml volumetric flask (or 10 ml graduated tube), dilute to the mark and store at 4°C for GPC cleanup.

2.7.5 Acidic Extraction

Acidify the sludge sample portions to pH ≤ 2 with 6 N hydrochloric acid and extract the sample again by procedures described in Sections 2.7.3 to 2.7.4. Discard the extracted sludge aliquots.

2.8 Extract Cleanup

2.8.1 GPC Setup and Calibration

2.8.1.1 Packing the column - Place 50 to 60 g of Bio Beads SX-3 in a 400 ml beaker. Cover the beads with dichloromethane and allow the beads to swell overnight (before packing the columns). Transfer the swelled beads to the column and start pumping solvent through the column, from bottom to top, at 5.0 ml/min. After ~1 hour, adjust the pressure on the column to 7 to 10 psi and pump an additional 4 hours to remove air from the column. Adjust the column pressure periodically as required to maintain 7 to 10 psi.

2.8.1.2 Calibration of the column - Load 5 ml of the corn oil solution into sample loop No. 1 and 5 ml of the phthalate-phenol solution into loop No. 2. Inject the corn oil and collect 10 ml fractions (i.e., change fraction at 2 minute intervals) for 36 minutes. Inject the phthalate-phenol solution and collect 10 ml fractions for 60 minutes. Determine the corn oil elution pattern by evaporation of each fraction to dryness followed by a gravimetric determination of the residue. Analyze the phthalate-phenol fractions by GC/FID on the SP-2250 and SP-1240-DA columns. Plot the concentration of each component in each fraction versus total eluent volume (or time) from the injection points. Choose a "dump time" which allows ≥85% removal of the corn oil and ≥85% recovery of the bis(2-ethylhexyl)-phthalate. Choose the "collect time" to extend at least 10 minutes after the elution of pentachlorophenol. "Wash" the column 20 minutes between samples. Typical parameters selected are: dump time, 20 minutes (100 ml), collect time, 30 minutes (150 ml), and wash time, 20 minutes (100 ml). The column can also be calibrated by the use of a 254 nm UV detector in place of gravimetric and GC analyses of fractions. Measure the peak areas at various elution times to determine appropriate fractions.

2.8.2 Operation

Prefilter or load all extracts via the filter holder to avoid particulates that might cause flow stoppage. Load one 5.0 ml aliquot for extracts of 10 ml volume. Purge the sample loading tubing thoroughly with solvent between extracts. After especially dirty extracts, run a GPC blank (i.e., dichloromethane) to check for carry-over. Process the extracts using the dump, collect, and wash parameters determined from the calibration and collect the cleaned extracts in 500 ml brown bottles. Concentrate the cleaned extracts, combining collected fractions from multiple injections, to ∿ 10 ml using Kuderna-Danish evaporators and then to ∿ 3 ml using micro Snyder columns. Transfer the cleaned extracts to 10 ml graduated tubes and dilute to 5.0 ml with dichloromethane. Store at 4°C for GC/MS analysis. Intensely colored extracts may require a second GPC cleanup.

2.9 Sample Extract Analysis

2.9.1 Acid Extracts

GC/MS analysis - Analyze acid extracts by GC/MS using the SP-1240-DA column described in Section 2.3.2.1, operated under the following conditions:

Column temperature - 85°C for 4 minutes, 85 to 200°C at 10°C/min and 200°C until after the elution time for 4-nitrophenol.

Injector temperature - 185°C

GC/MS interface temperature - 275°C

Carrier gas - Helium at 30 ml/min

Injection size - 2 µl

The MS should be repetitively scanned over the range m/e 40 to 475 at 3 sec/scan. Immediately prior to analysis, spike each extract with 50.0 µl of the internal standard solution of 2.0 µg/µl D-10-anthracene in dichloromethane.

2.9.2 Base/Neutral Pesticide Extracts

GC/MS analysis - Analyze the B/N/P extracts by GC/MS using the SP-2250 column described in Section 2.3.2.1 operated under the following conditions:

Column temperature - 50°C for 4 minutes, 50 to 260°C at 10°C/min, and 260°C until after the elution time for benz[*g*,*h*,*i*]perylene.

Injector temperature - 225°C

GC/MS interface temperature - 275°C

Carrier gas - Helium at 30 ml/min

Injection size - 2 µl

The MS should be repetitively scanned over the range m/e 40 to 475 at 3 sec/scan.

Immediately prior to analysis, spike each extract with 50.0 µl of the internal standard solution, which contains 2.0 µg/µl D-10-anthracene in dichloromethane.

2.10 Extractable Organics Analytical Quality Assurance

In addition to the instrumental quality assurance procedures specified in Sections 2.10.1 and 2.10.2, analyses of replicate and fortified samples and blanks are required to indicate the method precision and accuracy. Since the method precision may be very dependent on the sample matrix, the frequency and selection of replicate and fortified samples, method and field blanks, and fortified blanks is designed to provide some precision and accuracy data for each sample matrix encountered and is consistent with the objectives and limitations of screening analyses.

2.10.1 Method Blanks

Analyze one method blank (i.e., organic-free water) and one method blank spiked with each of the representative semivolatile compounds at 10 times the detection limits for every 15 samples analyzed or at least once each month that analyses are being conducted. Method blanks and spiked blanks are extracted and the extracts cleaned by the same procedures used for samples. Analyze extracts of spiked blanks by the GC/MS procedures described in Section 2.0. Analyze extracts of blanks by GC/FID using the same chromatographic columns and conditions. Analyze all blank extracts by GC/MS that exhibit peaks more intense than the D-10-anthracene internal standard.

2.10.2 Analytical Standards

2.10.2.1 Acidic Compounds

2.10.2.2 Analytical Quality Assurance

2.10.2.2.a Analyze daily a GC/MS quality assurance solution containing 10 ng/µl decafluorotriphenylphosphine (DFTPP), and 20 ng/µl of D-10-anthracene and 50 ng/µl 4-nitrophenol. Detection of 4-nitrophenol and the acceptability of the DFTPP spectrum quality, based on the ion abundance standards outlined in Table 2.3, are necessary criteria for proceeding with sample extract analyses.

2.10.2.2.b Analyze daily a standard solution containing each of the acidic compounds listed in Table 2.1 in the concentration range of 50 to 200 ng/µl plus D-10-anthracene at 20 ng/µl. Response factor data obtained from these standards are used to estimate the concentrations of compounds identified in sample extracts.

2.10.2.3 Base/Neutral and Pesticide Compounds

2.10.2.3.a Analyze daily a GC/MS quality assurance solution containing 10 ng/µl DFTPP, 20 ng/µl D-10-anthracene, and 50 ng/µl benzidene. Detection of benzidene and the acceptability of the DFTPP spectrum quality (see Table 2.3) are necessary criteria for proceeding with sample extract analyses.

2.10.2.3.b Analyze daily standard solutions containing the base/neutral and pesticide compounds listed in Table 2.1 in the concentration range of 20 to 100 ng/µl plus D-10-anthraceene at 20 ng/µl. Response factor data obtained from these standards are used to estimate the concentrations of compounds identified in sample extracts.

2.10.3 Field Blanks

Extract an 80 ml aliquot of each field blank by bech extraction with 3 100 ml portions of dichloromethane in a 1,000 ml separatory funnel. Dry the extract by passage through a short column of anhydrous Na_2SO_4 and concentrate to 1.0 ml in a Kuderna-Danish evaporator. Analyze field blank extracts by GC/FID using the chromatographic columns and conditions described in Section 2.0. Analyze all blank extracts by GC/MS that exhibit peaks more intense than the D-10-anthracene internal standard.

2.10.4 Fortified and Duplicate Samples

2.10.4.1 Sample Selection - After the analysis of samples collected at the first sampling time, spike and analyze duplicate sample aliquots from the first samples. For example, for a survey program sampling a POTW plant daily for 4 to 6 days, collect triplicate samples for the first day. After completing analyses of one set of the first day samples, spike and analyze duplicate first day samples. Spike the first day samples using procedures described in Section 2.10.4.2. The frequency of selecting spiked duplicate samples for analysis for sampling programs longer than 6 days should be determined from the detention times of the sludge types sampled so as to reflect possible changes in sample matrix.

2.10.4.2 Fortification Procedures - Spike an 80 ml aliquot of sludge with all of the compounds identified in the sample and the representative semivolatile compounds listed in Table 3.2 to produce a final concentration that is two times the observed concentration or 10 times the lower limit of detection reported in Table 2.9, whichever is greater. The spike should be contained in two acetone solutions. The first contains acidic and neutral compounds and the second contains basic compounds. The concentrations of the spiking solutions should be such that 1 to 5 ml of each solution are added to the sludge sample. Homogenize the spiked sample for 45 to 60 sec and store at 4°C overnight before extraction and analysis.

2.11 Data Handling

Using the characteristic retention times and ions listed in Tables 2.4 to 2.6, obtian EICP's of the characteristic ions for each compound. Verify the presence of the compounds of interest based on the coincidences of peaks in the characteristic EICPs at the appropriate retention times with intensities in the characteristic ratios. Calculate the concentrations of compounds identified by comparing the areas of the primary (highest abundance) ion EICP peaks with the areas of the corresponding standard peaks. If the sample matrix produces a significant interference with the primary ion EICP, a secondary ion EICP may be used for quantitation. Calculate the concentration of compounds identified in the sample as follows:

$$\left(\frac{A}{B}\right)\left(\frac{B_{IS}}{A_{IS}}\right)\left(\frac{V_E}{V_1}\right)\left(\frac{N}{V_S}\right)\left(\frac{1}{F}\right) = \text{µg/liter of analyte in wet sludge}$$

where:

A = area of peak in sample extract

B = area of peak in standard

A_{IS} = area of internal standard peak in sample extract

B_{IS} = area of internal standard peak in standard

V_1 = volume of extract injected (µl)

V_E = total volume of extract (ml)

N = nanograms in standard

V_S = volume of wet sludge extracted (l)

F = fraction of extract cleaned by GPC for analysis (e.g., $\frac{20\text{ ml}}{25\text{ ml}} = .8$).

Table 2.1. Semivolatile Organic Priority Pollutants

ACIDS

4-Chloro-3-methylphenol
2-Chlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
4,6-Dinitro-2-methylphenol
2-Nitrophenol
4-Nitrophenol
Pentachlorophenol
Phenol
2,4,6-Trichlorophenol

BASES

Benzidine
3,3'-Dichlorobenzidine

NEUTRALS

Polycyclic Aromatic Hydrocarbons

Acenaphthene
Acenaphtylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Chrysene
Dibenzo(a,g)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Pyrene

Phthalates

Bis(2-ethylhexyl) phthalate
Butylbenzyl phthalate
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate

Chlorinated Hydrocarbons

2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dcihlorobenzene
1,4-Dichlorobenzene
Hexachlorobenzene
Hexachloro-1,3-butadiene
Hexachloroethane
Hexachlorocyclopentadiene
1,2,5-Trichlorobenzene

Chloroalkyl Ethers

Bis-(2-chloroethyl) ether
Bis-(2-chloroethoxy)methane
Bis-(2-chloroisopropyl) ether
2-Chloroethyl vinyl ether

Table 2.1 (Concluded)

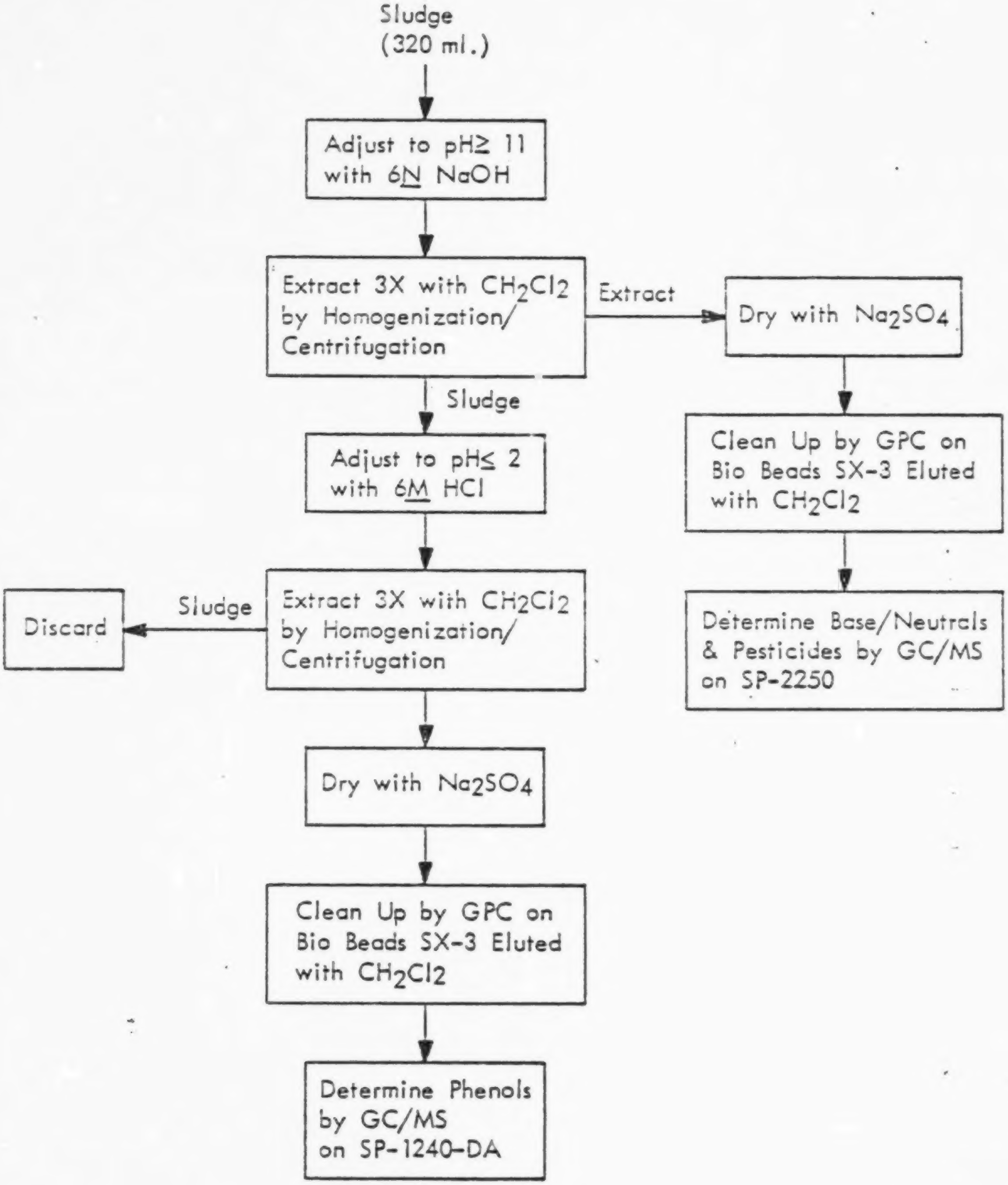
NEUTRALS

Miscellaneous Neutrals

4-Bromophenyl phenyl ether
4-Chlorophenyl phenyl ether
2,4-Dinitrotoluene
N-Nitrosodiethylamine
N-Nitrosodimethylamine
2,6-Dinitrotoluene
Isophorone
Nitrobenzene
N-Nitrosodiphenylamine

PESTICIDES

β-Endosulfan
α-BHC
γ-BHC
β-BHC
Aldrin
Heptachlor
Heptachlor epoxide
α-Endosulfan
Dieldrin
4,4'-DDE
4,4'-DDD
4,4'-DDT
Endrin
Endosulfan sulfate
δ-BHC
Chlordane
Toxaphene
PCB-1242
PCB-1254


Sludge
(320 ml.)
Adjust to pH≥ 11 with 6N NaOH
Extract 3X with CH_2Cl_2 by Homogenization/ Centrifugation
Extract
Dry with Na_2SO_4
Sludge
Adjust to pH≤ 2 with 6M HCl
Clean Up by GPC on Bio Beads SX-3 Eluted with CH_2Cl_2
Discard
Sludge
Extract 3X with CH_2Cl_2 by Homogenization/ Centrifugation
Determine Base/Neutrals & Pesticides by GC/MS on SP-2250
Dry with Na_2SO_4
Clean Up by GPC on Bio Beads SX-3 Eluted with CH_2Cl_2
Determine Phenols by GC/MS on SP-1240-DA

Analysis Scheme for Semivolatile Organics

Table 2.2. Unstable B/N Compounds

bis(2-Chloroisopropyl) ether
Nitrobenzene
N-Nitroso-di-n-propylamine
bis(2-Chloroethoxy) methane
Isophorone
2,6-Dinitrotoluene
2,4-Dinitrotoluene
1,2-Diphenylhydrazine
Benzidine
3,3'-Dichlorobenzidine
N-Nitrosodimethylamine

Table 2.3. DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	30-60% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	40-60% of mass 198
197	less than 1% of mass 198
198	base peak, 100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	1% of mass 198
441	less than mass 443
442	greater than 40% of mass 198
443	17-23% of mass 442

Table 2.4. Acid Compounds

Compound Name	RRT[a] D-10-Anthracene	Characteristic El Ions (Rel. Int.)
2-Chlorophenol	0.38	128(100), 64(54), 130(31)
2-Nitrophenol	0.43	139(100); 65(35), 109(8)
Phenol	0.50	94(100), 65(17), 66(19)
2,4-Dimethyl phenol	0.58	122(100), 107(90), 121(55)
2,4-Dichlorophenol	0.60	162(100), 164(50), 98(61)
2,4,6-Trichlorophenol	0.74	196(100), 198(92), 200(26)
4-Chloro-m-cresol	0.83	142(100), 107(80), 144(32)
2,4-Dinitrophenol	1.03	184(100), 63(59), 154(53)
4,6-Dinitro-o-cresol	1.04	198(100), 182(35), 77(28)
Pentachlorophenol	1.15	266(100), 264(62), 268(63)
4-Nitrophenol	1.70	65(100), 139(45), 109(72)

---

[a] Column: 1.2 m x 2 mm ID glass; 1% SP-1240 DA on 100/120 Supelcoport; He at 30 ml/min.
Program: 85°C for 4 min, then 10°C/min to 200°C and hold for 15 min.

Table 2.5. Base-Neutral Compounds

Compound Name	RRT[a/] D-10-Anthracene	Characteristic EI Ions (Rel. Int.)
1,3-Dichlorobenzene	0.31	146(100), 148(64), 113(12)
1,4-Dichlorobenzene	0.33	146(100), 148(64), 113(11)
Hexachloroethane	0.35	117(100), 199(61), 201(99)
1,2-Dichlorobenzene	0.35	146(100), 140(64), 113(11)
Bis(2-chloroisopropyl) ether	0.37	45(100), 77(19), 79(12)
Hexachlorobutadiene	0.48	225(100), 223(63), 227(65)
1,2,4-Trichlorobenzene	0.49	74(100), 109(80), 145(52)
Napthalene	0.51	128(100), 127(10), 129(11)
Bis(2-chloroethyl) ether	0.55	93(100), 63(99), 95(31)
Hexachlorocyclopentadiene	0.59	237(100), 235(63), 272(12)
Nitrobenzene	0.45	77(100), 123(50), 65(15)
Bis(2-chloroethoxy)methane	0.50	93(100), 95(32), 123(21)
2-Chloronaphthalene	0.68	162(100), 164(32), 127(31)
Acenaphthylene	0.75	152(100), 153(16), 151(17)
Acenaphthene	0.77	154(100), 153(95), 152(53)
Isophorone	0.47	82(100), 95(14), 138(18)
Fluorene	0.85	166(100), 165(80), 167(14)
2,6-Dinitrotoluene	0.81	165(100), 63(72), 121(23)
1,2-Diphenylhydrazine[b/]	0.87	77(100), 93(58), 105(28)
2,4-Dinitrotoluene	0.85	165(100), 63(72), 121(23)
N-Nitrosodiphenylamine[c/]	0.89	169(100), 168(71), 167(50)
Jexacj;prpbemzeme	0.92	284(100), 142(30), 249(24)
4-Bromophenyl phenyl ether	0.92	248(100), 250(99), 141(45)
Phenanthrene	1.00	178(100), 179(16), 176(15)
Anthracene	1.00	178(100), 179(16), 176(15)
Dimethyl phthalate	0.78	163(100), 164(10), 194(11)
Diethyl phthalate	0.87	149(100), 178(25), 150(10)
Fluoranthene	7.18	202(100), 101(23), 100(14)
Pyrene	1.22	202(100), 101(26), 100(17)
Di-n-butyl phthalate	1.09	149(100), 150(27), 104(10)
Benzidine	1.27	184(100), 92(24), 185(13)
Butylbenzyl phthalate	1.34	149(100), 91(50)
Chrysene	1.40	229(100), 229(19), 226(23)
Di-(2-ethylhexyl) phthalate	1.37	149(100), 167(31), 279(26)
Benzo(a)anthracene	1.41	228(100), 229(19), 226(19)
Di-n-octylphthalate	1.41	149(100), 167, 279
Benzo(b)fluoranthene	1.43	252(100), 253(23), 125(15)
Benzo(k)fluoranthene	1.43	252(100), 253(23), 125(16)
Benzo(a)pyrene	1.50	252(100), 253(23), 125(21)
Indeno(1,2,3-cd)pyrene	1.86	276(100), 138(28), 277(27)

Table 2.5 (Concluded)

Compound Name	RRT D-10-Anthracene	Characteristic EI Ions (Rel. Int.)
Benzo(g,h,i)perylene	1.98	276(100), 138(37), 277(25)
N-Nitrosodimethylamine	0.15	42(100), 74(88), 44(21)
N-Nitrosodi-n-propylamine	0.42	130(22), 42(64), 101(12)
4-Chlorophenyl phenyl ether	0.85	204(100), 206(34), 141(29)
3,3'-Dichlorobenzidine	1.45	252(100), 254(66), 126(16)
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.33	322(100), 320(90), 59(95)
Bis(chloromethyl)ether	--	45(100), 49(14), 51(5)
Deuterated anthracene (d10)	1.00	188(100), 94(19), 80(18)

---

a/ 1% SP-2250 on 100/120 mesh Supelcoport in a 1.8 m x 2 mm ID glass column; He at 30 ml/min. Program: 50°C for 4 min, then 10°C/min to 260°C and hold for 15 min.

b/ Elutes as azobenzene.

c/ Elutes as diphenylamine.

Table 2.6. Pesticides

Compound Name	RRT[a/] D-10-Anthracene	Characteristic EI Ions (Rel. Int.)
β-endosulfan	0.47	201(100), 283(48), 278(30)
α-BHC	0.94	183(100), 109(86), 181(91)
γ-BHC	1.00	183(100), 109(86), 181(91)
β-BHC	1.03	181(100), 183(93), 109(62)
Aldrin	1.05	66(100), 220(11), 263(73)
Heptachlor	1.06	100(100), 272(60), 274(46)
Heptachlor epoxide	1.13	355(100), 353(79), 351(60)
α-Endosulfan	1.14	201(100), 283(48), 278(30)
Dieldrin	1.18	79(100), 263(28), 279(22)
4,4'-DDE	1.20	246(100), 248(64), 176(65)
4,4'-DDD	1.22	235(100), 237(76), 165(93)
4,4'-DDT	1.27	235(100), 237(72), 165(59)
Endrin	1.30	81(100), 82(61), 263(70)
Endosulfan sulfate	1.30	272(100), 387(75), 422(25)
δ-BHC	1.04	183(100), 109(86), 181(90)
Chlordane	1.05-1.26	373(19), 375(17), 377(10)[b/]
Toxaphene	1.12-1.35	(231, 233, 235)[c/]
PCB-1242	0.86-1.14	(224, 260, 294)[c/]
PCB-1254	1.09-1.30	(294, 330, 362)[c/]

---

a/ 1% SP-2250 on 100/120 mesh Supelcoport in a 1.8 m x 2 mm ID glass column; He at 30 ml/min. Program: 50° for 4 min, then 10°C/min to 260° and hold for 15 min.

b/ These three ions are characteristic for the α and γ forms of chlordane. No stock should be set in these three for other isomers.

c/ These ions are listed without relative intensities since the mixtures they represent defy characterization by three masses.

APPENDIX I

Table A-1. Elution Order and Fortification Detection Limits of Volatile Priority Pollutants a/

Reproduced from best available copy.

Compound	RRT b/	Detection limit c/ (ng)
Chloromethane	0.152	50
Dichlorodifluoromethane	0.172	800
Bromomethane	0.181	800
Vinyl chloride	0.186	75
Chloroethane	0.204	800
Methylene chloride	0.292	20
Trichlorofluoromethane	0.372	150
1,1-Dichloroethylene	0.380	50
Bromochloromethane (IS)	0.457	-
1,1-Dichloroethane	0.469	75
Trans-1,2-dichloroethylene	0.493	50
Chloroform	0.557	50
1,2-Dichloroethane	0.600	50
1,1,1-Trichloroethane	0.672	50
Carbon tetrachloride	0.684	50
Bromodichloromethane	0.750	75
Bis-chloromethyl ether	0.760	d/
1,2-Dichloroporpane	0.818	50
Trans-1,3-dichloropropene	0.847	50
Trichloroethylene	0.867	50
Dibromochloromethane	0.931	50
Cis-1,3-dichloropropene	0.913	50
1,1,2-Trichloroethane	0.913	50
Benzene	0.937	5
2-Chloroethylvinyl ether	0.992	50
2-Bromo-1-chloropropane (IS)	1.000	-
Bromoform	1.115	50
1,1,2,2-Tetrachloroethene	1.262	50
1,1,2,2-Tetrachloroethane	1.281	50
1,4-Dichlorobutane (IS)	1.312	-
Toluene	1.341	5
Chlorobenzene	1.489	10
Ethylbenzene	1.814	5
Acrolein	Unknown	500
Acrylonitrile	Unknown	250

a/ These data were obtained under the following conditions: GC column - stainless steel, 8-ft long x 0.1 in. I.D. packed with Carbopack C (60/80 mesh), coated with 0.2% Carbowax 1500; carrier flow - 30 ml/min; oven temperature - initial 60°C held for 3 min, programmed 8°C/min to 160°C and held until all compounds eluted.

b/ Retention times relative to 2-bromo-1-chloropropane with an absolute retention time of 829 sec.

c/ Detection limit for fortification protocol assuming a 1 ml sample aliquot of a sludge with 5% solids content actual detection limits may vary slightly.

d/ Half-life of approximately 10 sec in aqueous mixtures.

Table A-2. Fortification Detection Limits for Base, Neutral, Pesticide, and Acid Extractable Organic Priority Pollutant Compounds

Detection Limit Range[a/] ng/ml	Compound
< 10	Naphthalene
	Fluorene
	Di-n-butylphthalate
	Fluoranthene
	Pyrene
	Bis(2-ethylhexyl)phthalate
	Acenaphthylene
	Diethylphthalate
	Benzo(k)fluoranthene
	Bis(2-chloroisopropyl)ether
	1,2-diphenylhydrazine
	Phenanthrene/anthracene
10 - 20	2-Chloronaphthalene
	Acenaphthalene
	2,6-Dinitrotoluene
	Butylbenzylphthalate
	Benzo[a]pyrene
	1,2,4-Trichlorobenzene
	Dimethylphthalate
	Di-n-octylphthalate
	4-Chlorophenylphenylether
	Hexachlorobenzene
	Benzidine
	3,3'-Dichlorobenzidine
	4,4'-DDE
	4,4'-DDT
	Toxaphene
	Chrysene/benzo[a]anthracene
20 - 30	m-Dichlorobenzene
	> o-Dichlorobenzene<p-dichlorobenzene
	Hexachlorobutadiene
	N-Nitrosodiphenylamine
	4-Bromophenylphenylether
	Dibenzo[a,b]anthracene
	Hexachloroethane
	Benzo[g,h,i]perylene
	Aldrin
	Phenol

Table A-2 (Concluded)

Detection Limit Range ng/ml		Compound
30 - 40		Bis(2-chloroethyl)ether
		α-BHC
		γ-BHC
		Endrin
		Heptachlor
		2-Chlorophenol
40 - 50		2,4-Dinitrotoluene
		N-Nitroso-di-n-propylamine
		δ-BHC
		2,4-Dimethylphenol
		2,4-Dichlorophenol
50 - 100		Nitrobenzene
		Bis(2-chloroethoxy)methane
		Hexachlorocyclopentadiene
		β-BHC
		Heptachlor epoxide
		Dieldrin
		2-Nitrophenol
		Trichlorophenol
		p-Chloro-m-cresol
~ 230	200	Pentachlorophenol
~ 240		4,6-Dinitro-o-cresol
~ 310	300	p-Nitrophenol
~ 340		Isophorone
~ 630 - 600		2,4-Dinitrophenol

---

a/ Detection limit based on standard responses and a minimum count of 1,000 for compound identification. Detection limits are for the original analyte concentration in sludge and presumes use of this protocol.

SECTION III

made up to 10 ml volumes with organic-free water. The resultant analyte concentrations are 5 µg/liter and 25 µg/liter (or 50 ng and 250 ng analyte weights, respectively).

Since reduced sensitivity is frequently observed for the more volatile purgeable compounds, including acrylonitrile, bromomethane, chloromethane, chloroethane, dichlorodifluoromethane, and vinyl chloride, these compounds should be present in the multicomponent standard at higher concentrations. A four-fold increase in the concentrations of bromomethane, chloromethane, chloroethane, dichlorodifluoromethane, and vinyl chloride to produce 4 µg/ml final concentrations of these compounds in the multicomponent secondary dilution will result in more reliable analyte responses. Similarly, a five-fold increase in the acrylonitrile concentration to 5 µg/ml in the multicomponent standard is also desirable.

1.6.1.2 Preparation from commercial mixed stock solutions - As an alternate to the preparation of standards from neat materials, high concentration stock mixtures of volatile organic priority pollutants may be purchased commercially. The method outlined below is specifically designed for utilizing stock mixtures available from Supelco, Inc.

INTERIM REPORT

QUALITY ASSURANCE FOR LABORATORY ANALYSIS OF 129 PRIORITY POLLUTANTS

PREPARED FOR:

ENVIRONMENTAL PROTECTION AGENCY
MONITORING & DATA SUPPORT DIVISION
OFFICE OF WATER PLANNING & STANDARDS
401 M STREET, S.W.
WASHINGTON, D.C. 20460

PREPARED BY:

VERSAR INC.
6621 ELECTRONIC DRIVE
SPRINGFIELD, VIRGINIA 22151
(703) 750-3000

CONTRACT NO. 68-01-5948
TASK 1.4

FEBRUARY 4, 1980

QUALITY ASSURANCE FOR LABORATORY ANALYSIS OF PRIORITY POLLUTANTS

i Preface
ii List of Tables
iii List of Figures
iiii Acknowledgements

I INTRODUCTION
II GENERAL QUALITY CONTROL CONSIDERATIONS AND ANALYTICAL METHODOLOGIES
III PRIORITY POLLUTANT LABORATORY QUALITY CONTROL
IV PERFORMANCE CONTROL LIMITS FOR PRIORITY POLLUTANTS

TABLE OF CONTENTS

Page

PREFACE iii
ACKNOWLEDGMENTS v

Chapter

1 IMPORTANCE OF QUALITY CONTROL 1-1
1.1 General 1-1
1.2 Quality Assurance Programs 1-1
1.3 Analytical Methods 1-2
1.4 Reference 1-4

2 LABORATORY SERVICES 2-1
2.1 General 2-1
2.2 Distilled Water 2-1
2.3 Compressed Air 2-5
2.4 Vacuum 2-5
2.5 Hood System 2-5
2.6 Electrical Services 2-6
2.7 References 2-6

3 INSTRUMENT SELECTION 3-1
3.1 Introduction 3-1
3.2 Analytical Balances 3-1
3.3 pH/Selective-Ion Meters 3-3
3.4 Conductivity Meters 3-6
3.5 Turbidimeters (Nephelometers) 3-7
3.6 Spectrometers 3-8
3.7 Organic Carbon Analyzers 3-13
3.8 Gas Chromatographs 3-14
~~3.9~~ References 3-14

4 GLASSWARE 4-1
4.1 General 4-1
4.2 Types of Glassware 4-2
4.3 Volumetric Analyses 4-3
4.4 Federal Specifications for Volumetric Glassware 4-4
4.5 Cleaning of Glass and Porcelain 4-5
4.6 Special Cleaning Requirements 4-6
4.7 Disposable Glassware 4-7
4.8 Specialized Glassware 4-7
4.9 Fritted Ware 4-8
4.10 References 4-9

5 REAGENTS, SOLVENTS, AND GASES 5-1
5.1 Introduction 5-1
5.2 Reagent Quality 5-1

5.3 Elimination of Determinate Errors 5-4
5.4 References 5-4

6 QUALITY CONTROL FOR ANALYTICAL PERFORMANCE 6-1
6.1 Introduction 6-1
6.2 The Industrial Approach to QC 6-1
6.3 Applying Control Charts in Environmental Laboratories 6-2
6.4 Recommended Laboratory Quality Assurance Program 6-9
6.5 Outline of a Comprehensive Quality Assurance Program 6-10
6.6 Related Topics 6-13
6.7 References 6-13

7 DATA HANDLING AND REPORTING 7-1
7.1 Introduction 7-1
7.2 The Analytical Value 7-1
7.3 Glossary of Statistical Terms 7-3
7.4 Report Forms 7-5
7.5 References 7-11

8 SPECIAL REQUIREMENTS FOR TRACE ORGANIC ANALYSIS . . . 8-1
8.1 Introduction 8-1
8.2 Sampling and Sample Handling 8-1
8.3 Extract Handling 8-4
8.4 Supplies and Reagents 8-5
8.5 Quality Assurance 8-7
8.6 References 8-10

9 SKILLS AND TRAINING 9-1
9.1 General 9-1
9.2 Skills 9-2
9.3 Training 9-4

10 WATER AND WASTEWATER SAMPLING 10-1
10.1 Introduction 10-1
10.2 Areas of Sampling 10-2
10.3 References 10-6

11 RADIOCHEMISTRY 11-1
11.1 Introduction 11-1
11.2 Sample Collection 11-1
11.3 Laboratory Practices 11-2
11.4 Quality Control 11-4
11.5 References 11-5

12 MICROBIOLOGY 12-1
12.1 Background 12-1
12.2 Specific Needs in Microbiology 12-1
12.3 Intralaboratory Quality Control 12-2
12.4 Interlaboratory Quality Control 12-2
12.5 Development of a Formal Quality Assurance Program 12-3
12.6 Documentation of a Quality Assurance Program 12-3

12.7 Chain-of-Custody Procedures for Microbiological Samples 12-8
12.8 References 12-10

13 AQUATIC BIOLOGY 13-1
13.1 Summary of General Guidelines 13-1
13.2 Discussion 13-2
13.3 Reference 13-4

14 LABORATORY SAFETY 14-1
14.1 Law and Authority for Safety and Health 14-1
14.2 EPA Policy on Laboratory Safety 14-5
14.3 Laboratory Safety Practices 14-7
14.4 Report of Unsafe or Unhealthful Condition 14-15
14.5 References 14-15

Appendix A–Suggested Checklist for the Safety Evaluation of EPA Laboratory Areas A-1

PREFACE

The following Quality Assurance Guide for Laboratory Analysis of Priority Pollutants was produced at the request of the Monitoring and Data Support Division of the Office of Water Planning and Standards to support the National Urban Runoff Program surveillance and analysis effort. The objective of this report is to reflect EPA's best effort and understanding of what steps and actions are required to define the meaningfulness of laboratory analysis.

LIST OF TABLES

1. Priority Pollutant Fractions to be Analyzed
2. Purgeable Organic Fraction
3. Base/Neutral Fraction
4. Acid Fraction
5. Pesticide Fraction
6. Metals Fraction
7. Conventional Fraction
8. Priority Pollutant Batch Size Effect on Relative QC Effort
9. Standard QC Format (example)
10. Surrogate Recovery Format (example)
11. Purgeable Fraction - Matrix Effect Spike
12. Purgeable Fraction - Surrogate Spike
13. Acid Fraction - Matrix Effect Spike
14. Acid and Base/Neutral Fraction - Surrogate Spike
15. Base/Neutral Fraction - Matrix Effect Spike
16. Pesticide Fraction - Matrix Effect Spike
17. Metals Fraction - Matrix Effect Spike
18. Conventional Fraction - Matrix Effect Spike
19. Possible Sources of Standards
20. Intra-Laboratory Comparison
21. Purgeable Organics
22. Acid Fraction
23. Base/Neutral Fraction
24. Pesticide Fraction
25. Metals, Cyanide and Phenolics
26. Priority Pollutant Surrogates

LIST OF FIGURES

1. Handbook for Analytical Quality Control
2. Summary of Required Samples and Audits for Priority Pollutant Analysis

ACKNOWLEDGEMENTS

This document rests on the work and comes about throught the efforts of numerous laboratories and scientists. Notable amoung the contributors are R.D. Kleopfer and B.J. Fairless at Region VII, Kansas City, Kansas; D. Ballanger and staff at EMSL, Cincinnati, Ohio; and the Versar Inc. staff at Springfield, Va.

I INTRODUCTION

This document defines those actions that must be taken to assure that valid priority pollutant data is produced by analytical laboratories. The general day-to-day procedures will be referred to as quality control (QC) activities. The implementation coordination and supervision of these procedures will be referred to as quality assurance (QA) activities. In this broader sense, the program will cover the four major aspects of a quality assurance program. Under the title of good laboratory practice will be covered reference to all aspects of laboratory operation. The main areas of procedures and methods will also be summarized. The major effort in this program will be to develop a workable day-to-day QC model and, secondly, to provide the detail control limits against which to measure a laboratory's performance.

The methodologies and procedures, as well as associated good laboratory practice, required to do the analysis will be defined primarily through references. All references to procedures and methods are based on EPA usual practice. EPA concludes that these methodologies are adequate for priority pollutant analysis. The adequacy of the data produced has been recently summarized in an EPA report as follows:

> "We can be confident that false positive analysis are considerably less likely than false negative analysis so that when a priority pollutant is detected in the environment, we know the measured quantity is probably smaller than the true value."

Two principal areas specific to priority pollutants are addressed in this presentation. The first spells out those actions that must be taken to assure that data produced will be of known quality. The second presents criteria against which analytical data can be judged. Taken together, this document will assure data that is statistically valid, defensible and of known precision and accuracy.

For most study work where the priority pollutants are really unknown, where matrix effects are undefined and where sampling conditions are uncertain, the procedures and QC practices specified here represent the most cost-effective solution to a complex problem. As routine monitoring programs develop, a relative reduction in the required quality control activities and, hence, the cost is expected. Such considerations in cost reduction fall into a broader management purview of quality assurance than this document addresses.

A comprehensive Laboratory Quality Control Program attempts to answer the following sorts of questions:

(1) Are the field samples contaminated?
(2) Is the analytical instrument working?
(3) Are all matrix effects under control?
(4) Was each sample properly handled in the laboratory?
(5) Is the precision of the analysis in the acceptable range?
(6) Is the laboratory uncontaminated?

Unless the answer to all of these questions is "yes," there is reasonable doubt, for every sample batch, that valid data is being acquired. These questions are answered by analyzing, along with the samples, solutions prepared to address these concerns. A sample is defined as that portion of water chosen to characterize a specific site. Any other solution is to be considered as a quality control audit. This distinction can be made clear by considering a duplicate sample taken in the field. One of the pair is a sample solution and the other a quality control audit solution. The comprehensive set of QC audit solutions to answer all of the above concerns include:

(1) A field blank
(2) A method standard
(3) A duplicate spiked with compounds of interest
(4) A duplicate analyzed
(5) A laboratory blank

The main control objectives and many minor control objectives can be accomplished by running five quality control checks with each batch of twenty samples completed in one day. This model will be expanded in detail considering the entire priority pollutant list of organic and inorganic parameters in Section III.

The 129 toxic and/or priority pollutants are given in Tables 2-7. This QA document addresses all of these except asbestos which is not within the scope of this work. The toxics are grouped and named by their analytical methodologies. The class names of the toxics and the number of class members are defined in Table 1.

TABLE 1

PRIORITY POLLUTANT FRACTIONS TO BE ANALYZED

General Group	Class Name	Common Abbreviation	No. of Elements or Compounds
Organic Parameters	Purgeables	VOA	31
	Acids	A	11
	Base/Neutrals	B/N	46
	Pesticides	P	25
Inorganic Parameters	Metals		
	a. flame atomic absorption	AA	10
	b. furnace atomic absorption	FAA	2
	c. cold vapor atomic absorption		1
	Conventional, CN^- and Phenol		2
	Asbestos - not covered in this document		1
		Total	129

TABLE 2

PURGEABLE ORGANICS FRACTION

(1) Acrolein
(2) Acrylonitrile
(3) Benzene
(4) Bromodichloromethane
(5) Bromoform
(6) Bromomethane
(7) Carbon Tetrachloride
(8) Chlorobenzene
(9) Chlorodibromomethane
(10) Chloroethane
(11) 2-Chloro(ethyl vinyl) ether
(12) Chloroform
(13) Chloromethane
(14) Dichlorodifluoromethane
(15) 1,1-Dichloroethane
(16) 1,2-Dichloroethane
(17) 1,1-Dichloroethylene
(18) Trans-1,2-Dichloroethylene
(19) Dichloromethane
(20) 1,2-Dichloropropane
(21) Cis-1,3-Dichloropropene
(22) Trans-1,3-Dichloropropene
(23) Ethylbenzene
(24) 1,1,2,2-Tetrachloroethane
(25) Tetrachloroethylene
(26) Toluene
(27) 1,1,1-Trichloroethane
(28) 1,1,2-Trichloroethane
(29) Trichloroethylene
(30) Trichlorofluoromethane
(31) Vinyl Chloride

TABLE 3

BASE/NEUTRAL FRACTION

(1) Acenaphthene
(2) Acenapthylene
(3) Anthracene
(4) Benzidine
(5) Benzo(a)anthracene
(6) Benzo(b)fluoranthene
(7) Benzo(k)fluoranthene
(8) Benzo(a)pyrene
(9) Butyl Benzyl Phthalate
(10) Bis(2-chloroethyl) Ether
(11) Bis(2-chloroethoxy) Methane
(12) Bis(2-chloroisopropyl) Ether
(13) Bis(2-ethylhexyl) Phthalate
(14) 4-Bromophenyl Phenyl Ether
(15) Butyl Benzyl Phthalate
(16) 2-Chloronaphthalene
(17) 4-Chlorophenyl Phenyl Ether
(18) Chrysene
(19) Dibenzo(a,h)anthracene
(20) Di-n-butyl Phthalate
(21) 1,2-Dichlorobenzene
(22) 1,3-Dichlorobenzene
(23) 1,4-Dichlorobenzene
(24) 3,3'-Dichlorobenzidine
(25) Diethyl Phthalate
(26) Dimethyl Phthalate
(27) 2,4-Dinitrotoluene
(28) 2,6-Dinitrotoluene
(29) Di-n-octyl Phthalate
(30) 1,2-Diphenylhydrazine
(31) Fluoranthene
(32) Fluorene
(33) Hexachlorobenzene
(34) Hexachlorobutadiene
(35) Hexachlorocyclopentadiene
(36) Hexachloroethane
(37) Isophorone
(38) Indeno(1,2,3-cd)pyrene
(39) Naphthalene
(40) Nitrobenzene
(41) N-nitrosodimethylamine
(42) N-nitrosodiphenylamine
(43) N-nitrosodi-*n*-propylamine
(44) Phenanthrene
(45) Pyrene
(46) 1,2,4-Trichlorobenzene

TABLE 4

ACID FRACTION

(1) 2-Chlorophenol
(2) p-Chloro-m-cresol
(3) 2,4-Dichlorophenol
(4) 2,4-Dimethylphenol
(5) 4,6-Dinitro-o-cresol
(6) 2,4-Dinitrophenol
(7) 2-Nitrophenol
(8) 4-Nitrophenol
(9) Pentachlorophenol
(10) Phenol
(11) 2,4,6-Trichlorophenol

TABLE 5

PESTICIDE FRACTION

(1) Aldrin
(2) alpha-BHC
(3) beta-BHC
(4) gamma-BHC
(5) delta-BHC
(6) Chlordane
(7) 4,4'-DDD
(8) 4,4'-DDE
(9) 4,4'-DDT
(10) Dieldrin
(11) Endosulfan I
(12) Endosulfan II
(13) Endosulfan Sulfate
(14) Endrin
(15) Endrin Aldehyde
(16) Heptachlor
(17) Heptachlor Epoxide
(18-24) PCB (7 Aroclors)
(25) Toxaphene

TABLE 6

METALS FRACTION

(1) Antimony
(2) Arsenic
(3) Beryllium
(4) Cadmium
(5) Chromium
(6) Copper
(7) Lead
(8) Mercury
(9) Nickel
(10) Selenium
(11) Silver
(12) Thallium
(13) Zinc

TABLE 7

CONVENTIONAL FRACTION

(1) Cyanides
(2) Total Phenols

II GENERAL QUALITY CONTROL CONSIDERATIONS AND ANALYTICAL METHODOLOGIES

A. Laboratory Good Practice

The Environmental Monitoring and Support Laboratory document (EPA-600/4-79-019) contains all of the salient considerations which can form the general base for any Laboratory Quality Assurance Program. This document is available in looseleaf form and should be used by all laboratories in these programs. The abstract, and table of contents are included in this section to show the scope of its concerns (Figure 1).

B. Priority Pollutant Methodologies

The methods required to do the 129 priority pollutants are found in the following:

- "Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants," U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, March 1977 (revised April 1977).
- "Handbook for Analytical Control in Water and Wastewater Laboratories," U.S. EPA, Environmental Monitoring and Support, Cincinnati, OH 45268, March 1979.

The documents are available from the Environmental Monitoring and Support Laboratory (Cinc.). In addition, various other aspects of the required methods will be found in the following two references:

- "Procedure for Preliminary Evaluation of Analytical Methods to be Used in the Verification Phase of the Effluent Guidelines Division BAT Review," U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, March 1978
- "Addendum for Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants," U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, April 1979.

And, lastly, the alternative methodologies recently proposed are found in:

- Federal Register, Volume 44, No. 233, December 3, 1979. "Guidelines Establishing Test Procedures for the Analysis of Pollutants, Proposed Regulations."

FIGURE I

HANDBOOK FOR ANALYTICAL QUALITY CONTROL IN WATER AND WASTEWATER LABORATORIES

Environmental Monitoring & Support Laboratory
(Cincinnati)

- Abstract
- Table of Contents

12.

ABSTRACT

One of the fundamental responsibilities of water and wastewater management is the establishment of continuing programs to insure the reliability and validity of analytical laboratory and field data gathered in water treatment and wastewater pollution control activities.

This handbook is addressed to laboratory directors, leaders of field investigations, and other personnel who bear responsibility for water and wastewater data. Subject matter of the handbook is concerned primarily with quality control (QC) for chemical and biological tests and measurements. Chapters are also included on QC aspects of sampling, microbiology, biology, radiochemistry, and safety as they relate to water and wastewater pollution control. Sufficient information is offered to allow the reader to inaugurate or reinforce programs of analytical QC that emphasize early recognition, prevention, and correction of factors leading to breakdowns in the validity of water and wastewater pollution control data.

311<

III PRIORITY POLLUTANTS - LABORATORY QUALITY CONTROL

A. Introduction

This section is a summary of the efforts in several EPA and contract laboratories to develop a meaningful cost effective quality control model. A listing of required samples and controls for priority pollutant analysis can be seen in Figure 2. The general QC model will be discussed in the following sections as it is applied to each fraction of the priority pollutant list of 129. Five control solutions must be evaluated with each batch of samples. The impact of the number of samples in each batch is shown in Table 8. The 25 percent controls required by this model presupposes very little or no experience with the sample types and specific fractions under consideration. As a data base develops, one can envision that only samples spiked with surrogates would be used in the presence of sufficient data. For most developmental study work, however, the 25 percent baseline will have to be maintained to assure the quality of the agency data base. Lastly, this section will specify the quality control documentation requirements necessary to support this effort.

B. Basic Terms

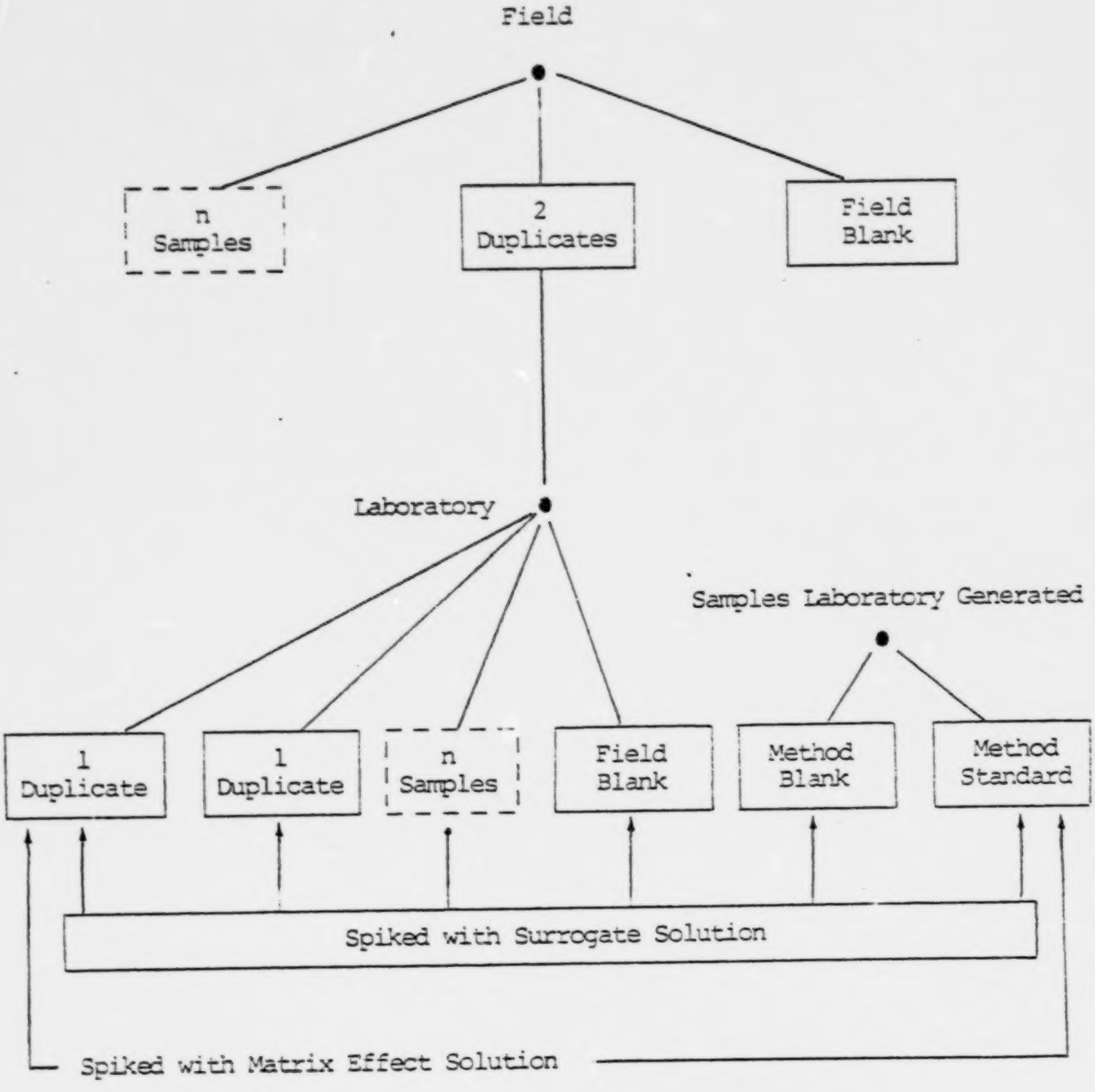
1. Sample

A sample is a representative portion of an item from which characteristics of the whole can be extracted. In this program, a sample is the volume of properly preserved water required to analyze for a specific pollutant(s) of a given fraction. If duplicate field samples are taken, the second one will be referred to as a QC control or a QC audit solution.

2. QA Audit Solution

A QC audit solution is the volume of water used to test some varible that it is desired to control. Examples of such solutions are spiked solutions, blanks of various kinds and, generally, any material that is used to ascertain the validity of the data.

SUMMARY OF REQUIRED SAMPLES AND CONTROLS
FOR
PRIORITY POLLUTANT ANALYSIS


Field
n Samples
2 Duplicates
Field Blank
Laboratory
Samples Laboratory Generated
1 Duplicate
1 Duplicate
n Samples
Field Blank
Method Blank
Method Standard
Spiked with Surrogate Solution
Spiked with Matrix Effect Solution

If, n = 20

Then, 25 samples would have to be analyzed

Figure 2

TABLE 8

PRIORITY POLLUTANT BATCH SIZE EFFECT ON RELATIVE QC EFFORT

No. Samples in 1 Batch	No. QC Controls	% QC
1	5	500
2	5	250
5	5	100
10	5	50
15	5	33
20	5	25

Batch sizes much greater than 20 are probably unrealistic.

The following subsections 3-15 are taken directly from a Region VII Document "Quality Assurance - Organic Parameters." Changes have been made to make their suggestions relevant to this document and to remove any responsibility for Region VII to provide either surrogate or matrix effect spikes.

3. Volatiles

The laboratory shall run one duplicate (same sample run twice), one field blank, one reagent blank (laboratory prepared "organic-free" water), one method standard (standard addition to "organic-free" water), and one matrix effect spike (standard addition to a sample) for each batch of samples processed.

The laboratory shall calculate the percent recovery of the surrogates and the standards using the external standard quantitiation method. The surrogate spikes will be added to every sample immediately before analysis begins. The standard additions will be added and held for one hour prior to the beginning of the analysis.

4. Extractables - Acids and Base/Neutrals

The laboratory shall run one duplicate, one field blank, one reagent blank, one method standard, and one matrix effect spike for each batch (a group of samples from each plant studied) of samples processed. The pesticides will be measured using the external standard method. The base/neutral and acid fractions will be measured using the internal standard method.

5. Method Blank

The method blank is defined as an appropriate volume of "organic-free" water which has been processed exactly as a sample (same glassware, reagents, solvents, etc.). For the extractable parameters (B/N, A, P), this would require extraction of one liter of water. For the volatile fraction, 5 ml of "organic-free" water should be analyzed by the purge and trap methodology. One method blank sample should be run with every batch of 20 or fewer samples. Also, a method blank should be run whenever a new source of reagent or solvent is introduced into the analytical scheme. Reagents having background levels that interfere with the compounds to be determined must be purified and shown to be free of known interferences or replaced with some that are acceptable.

6. Field Blank

It is the responsibility of the sampling team to provide the appropriate field blanks to the analytical team. For the extractable parameters (B/N, A, P), the minimum requirement is to provide an appropriate volume of blank water which has been processed through the sampling equipment in the same manner as a sample. The field blank is then analyzed in the laboratory as if it were a sample. When interferences occur, the analytical results must be discarded or flagged so as not to result in the reporting of false positives.

7. Replicates

To determine the precision of the method, a regular program of analyses of replicate aliquots of environmental samples must be carried out. At least two replicate aliquots of a well-mixed sample must be analyzed with each set of 20 samples or less analyzed at a given time. For those parameters where a sufficient number (15 sets) of positive results are accumulated over a period of time, precision criteria should be developed as described below.

After 15 replicate results have been obtained, calculate the range (R_i) of these results as follows:

$$R_i = X_{i1} - X_{i2} \tag{1}$$

where R_i is the difference between the results of the pair (X_{i1} and X_{i2}) from sample i=1 through n. The concentration of each sample is represented by the mean:

$$\overline{X}_i = \frac{(X_{i1} + X_{i2})}{2} \tag{2}$$

where $\overline{X}_i$ is the average of the results of the replicate pair. A preliminary estimate of the critical difference (R_c) between replicate analyses for any specific concentration (C) can be calculated as:

$$R_c = 3.27 \left(C \sum_{i=1}^{n} R_i\right) / \left(\sum_{i=1}^{n} \overline{X}_i\right) \tag{3}$$

From these data develop a table of such R_c values for various C values that span the concentration range of interest.

These preliminary critical difference values may be used to judge the acceptability of the succeeding replicate results. To do this, calculate the mean ($\overline{X}$) and difference (R) between the replicate results. Referring to the table of critical range values developed above, find the C nearest to $\overline{X}$ and use its R_c to evaluate the acceptability of R. If the R is greater than R_c, the system precision is out of control and the source of this unusual variability should be identified and resolved before continuing with routine analyses. Record the results of all replicate analyses and periodically (after 25 to 30 additional pairs of replicate results are obtained), revise, update, and improve the table of critical range values.

8. Matrix Effect Additions to Samples

These are additions of known amounts of authentic standards to the sample. The samples are then processed and analyzed in the same manner as a sample. For the convenience of the analyst, a "reference" standard addition should be provided. The "reference" standard should be prepared at the same time that the samples are being spiked using the same pipet and the same standard solution or solutions. The volume of the "reference" should then be adjusted by dilution, if necessary, to the same extract volume as will be delivered for the spiked sample. The reference is extremely valuable in determining accurate percent recovery because the same standard which was added to the sample can be used for quantitation purposes. This eliminates errors which might be introduced because of discrepancies between spiking standards and quantitation standards.

Determine the recovery of the method for the analysis of environmental samples by adding a spike (T_i, true value) sufficient to approximately double the background concentration level (if known prior to extraction) of the sample selected earlier for replicate analysis. If the original concentration is higher than the midpoint of the standard curve (range of the method), then the concentration of the spike should be approximately one-half the original concentration, which assures that the final concentration is within the linear range of the method. If the concentration of the original sample was not detectable, the concentration of the spike should be 5 to 15 times the lower limit of detection. Generally, the concentration present in the sample will be totally unknown prior to extraction; therefore, a spike which is 5 to 15 times above the lower detection limit is recommended. The volume of standard added in aqueous solution should not dilute the sample by more than 10 percent. The volume of standard added in an organic solvent solution should be kept small (100 µl/l or less).

Analyze the sample, calculated the observed value (O_i) and the solution concentration (X_i), then calculate the recovery for the spike as follows:

$$P_i = 100\ (O_i - X_i)/T_i \qquad (4)$$

where P_i is the percent recovery. If the sample was diluted due to the addition of the spike, adjust $\overline{X}_i$ accordingly.

After determining P_i for at least 15 spike results, calculate the mean percent recovery ($\overline{P}$) and standard deviation (S_p) of the recovery as follows:

$$\overline{P} = (\sum_{i=1}^{n} P_i)/n \qquad (5)$$

$$S_p = \sqrt{\frac{1}{n-1}\left[\sum_{i=1}^{n} P_i^2 - (\sum_{i=1}^{n} P_i)^2/n\right]} \qquad (6)$$

where n = the number of percent recovery values available.

If the percent recovery of the spike is not within the interval of $\overline{P} \pm 3\ S_p$, the system accuracy is out of control and the source of this systematic error should be identified and resolved before continuing with routine analysis.

At least one spiked sample must be analyzed along with each set of 20 samples or less that is analyzed at a given time. This spiked data must be obtained for each parameter of interest. Record the recovery data of all spiked analyses and periodically (every 25 to 30 data points), revise, update, and improve the accuracy criteria.

9. Matrix Effect Additions to Blank Water (Method Standard)

These are additions of known amounts of authentic standards to the water blank immediately before extraction. The samples are then processed and analyzed in the same manner as a sample. The standards should be approximately equal to the concentration found in routine samples.

Analyze the standard and calculate O_i (the observed value). The percent recovery (P_i) is then calculated as follows:

$$P_i = \frac{100\ (O_i)}{T_i} \tag{7}$$

where T_i = the true value.

After determining the P_i for approximately 15 check standards, calculate the mean ($\overline{P}$) and standard deviation (S_p) of the percentages as follows:

$$\overline{P} = \frac{\sum\limits_{i=1}^{n} P_i}{n} \tag{8}$$

and:

$$S_p = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} P_i^2 - \left(\sum_{i=1}^{n} P\right)^2/n} \tag{9}$$

where n = the number of results available.

If the percent recovery for succeeding standard additions is not within the interval of $\overline{P} \pm 2\ S_p$, the system should be checked for problems. If problems exist, they must be resolved before continuing with routine analysis.

At least one blank water standard addition must be analyzed along with each set of 20 samples or less that is analyzed at a given time. These data must be obtained for each parameter of interest. Record the recovery of all blank water standard additions and periodically revise, update, and improve the accuracy criteria.

10. Surrogate Spikes

These are standards which are added to every sample prior to analysis. The standards chosen should be chemically similar to compounds in the fraction being analyzed. Also, the standards should be compounds which would not likely be found in environmental samples. The purpose of the surrogate spike is to provide quality control on every sample by constantly monitoring the unusual matrix effects, gross sample processing errors, etc. The surrogate spike should not be used as an internal standard for quantitation purposes. Analyze the spike extract and calculate O_i (the observed value). The percent recovery (P_i) is then calculated as follows:

$$P_i = \frac{100\ (O_i)}{T_i} \tag{11}$$

where T_i = the true value.

After determining the P_i for approximately 15 spikes, calculate the mean ($\overline{P}$) and standard deviation (S_p) of the percentages as follows:

$$\overline{P} = \frac{\sum_{i=1}^{n} P_i}{n} \tag{12}$$

and

$$S_p = \sqrt{\frac{1}{n-1}\left[\sum_{i=1}^{n} P_i^{\,2} - \left(\sum_{i=1}^{n} P\right)^2/n\right]} \tag{13}$$

where n = the number of results available.

If the percent recovery for succeeding spikes is not within the interval of $\overline{P} \pm 3\ S_p$, the system should be checked for problems. If problems exist, they must be resolved before continuing with routine analysis. Record the recovery of all spikes and periodically revise, update, and improve the acceptance criteria as defined in Section IV.

11. GC/MS Calibration Check

For the base/neutral fraction, run decaflurotriphenylphosphine (DFTPP) daily according to EPA procedures. The requirement is for 20 nanograms of DFTPP to meet the specifications.

For the volatile fraction and the acid fraction, run pentaflurobromobenzene (PFBB) daily according to EPA procedures. The requirement is for 100 nanograms of PFBB to meet the specification.

12. GC Performance Check

For the base/neutral fraction, run benzidine daily either separately or as a part of a standard mixture. The requirement is to be able to chromatograph the compound at the 100 nanogram level.

For the acid fraction, run pentachlorophenol daily either separately or as part of a standard mixture. The requirement is to be able to chromatograph the compound at the 100 nanogram level.

For the pesticide fraction, run Aldrin daily either separately or as part of a standard mixture. An injection of 100 picograms should give a recorder response of at least 50 percent full-scale deflection.

13. Inter-Laboratory Quality Control

In addition to establishing the precision and accuracy of the method and routinely analyzing replicate and spiked samples, the laboratory must also analyze a quality control (QC) check sample, at least once annually, for parameters of interest as they are available from the Quality Assurance Branch, Environmental Monitoring and Support Laboratory (Cincinnati).

14. Quantitation

External Standard Method

The external standard method is recommended for quantitation of parameters from the pesticide fraction and the volatile fraction. Prepare a master calibration curve using a minimum of three standard solutions of each of the compounds that are to be measured. Plot concentrations versus integrated areas or peak heights (selected characteristic ion for GC/MS or electron capture response for GC/EC). One point on each curve should approach the method detection limit. Once the master set of instrument calibration curves have been established, they should be verified daily by injecting at least one standard solution. If significant drift has occurred, a new calibration curve will have to be constructed. The concentration of the unknown can be calculated from the slope and intercept of the curve. If the curve is linear and the intercept is zero, the unknown concentration can be determined by the following equations:

For extractables:

$$\text{Micrograms/liter} = \frac{(A)\ (B)\ (V_t)}{(V_i)\ (V_s)} \tag{14}$$

$A = \frac{\text{ng standard}}{\text{standard area}}$

B = sample aliquot area

V_i = volume of extract injected (µl)

V_t = volume of total extract (µl)

V_s = volume of water extracted (ml)

For volatiles:

$$\text{Micrograms/liter} = \frac{(A)\ (B)}{V_p} \tag{15}$$

V_p = volume of water purged (ml)

Internal Standard Method

The internal standard method is recommended for quantitation of parameters from the base/neutral fraction and the acid fraction.

This method is preferred when the internal standard meets the following conditions:

a. Does not interfere with other components
b. Elutes close to peaks of interest
c. Approximates concentration of unknown
d. Structurally similar to unknown

The utilization of the internal standard method requires the periodic determination of response factors (R) which are defined as followsL

$$R = \frac{A_S \, C_{IS}}{A_{IS} \, C_S} \qquad (16)$$

A_S is the integrated area or peak height of the characteristic ion for the priority pollutant standard.

A_{IS} is the integrated area or peak height of the characteristic ion for the internal standard.

C_{IS} is the concentration of the priority pollutant standard.

By adding a known concentration of internal standard (C_{IS}) to every sample extract, one can then calculate the concentration of priority pollutant (C_E) in the extract using:

$$C_E = \frac{A_S \, C_{IS}}{A_{IS} \, R} \qquad (17)$$

The concentration of priority pollutant in the original sample (C_O) is given by:

$$C_O = \frac{C_E \, V_E}{V_O} \qquad (18)$$

where V_E is the volume of the extract and V_O is the volume of the original sample.

The response factor (R) must be determined over all concentration ranges of standard (C_s) which are being determined. (Generally, the amount of internal standard added to each extract is the same so that C_{IS} remains constant.) This should be done by preparing a calibration chart where the response factor (R) is plotted against the standard concentration (C_s) using a minimum of three concentrations over the range of interest. Once this calibration plot has been determined, it should be verified daily by injecting at least one standard solution containing internal standard. If significant drift has occurred, a new calibration curve will have to be constructed.

To quantitate, add the internal standard to the concentrated sample extract no more than a few minutes before the measurement to protect the standard from losses due to evaporation, adsorption, or chemical reaction. Calculate the concentration, if unknown, by using the previous equations with the appropriate response factor taken from the calibration curve. (Ideally, the response factor will not change with concentration.)

15. Quality Assurance Documentation

Standard formats are to be utilized for reporting quality assurance data. One form would summarize all relevant data concerning blanks, standard additions, and replicates for each parameter (see Table 9). A second form would summarize surrogate recoveries for each fraction type (see Table 10). Other forms would provide daily records of GC/MS calibration checks and GC performance checks.

16. Combinations Used for Matrix Effect and Surrogate Spikes

A. Listing of Combinations and Concentrates

The following Tables 11 through 18 list the required materials and range of spiking levels for matrix effect spikes and surrogate spike for all fractions of the 129 priority pollutants. The following is a summary of the requirements.

		Spike Type	
	Fraction	Matrix Effect	Surrogate
1.	Purgeables	Table 11	Table 12
2.	Acids	Table 13	Table 14
3.	Base/Neutrals	Table 15 (Note: 4 mixes)	Table 14
4.	Pesticides	Table 16 (Note: 5 mixes)	None
5.	Metals	Table 17	None
6.	CN^-, Phenol	Table 18	None

B. Availability of Spiking Solutions

Either each laboratory must prepare all matrix effect and surrogate spikes or stock solutions are prepared at a central location and distributed to each laboratory in a given program. In order to optimize data quality at the minimum cost, the latter is the best approach. Region VII has provided such a service in other programs and in the following section is presenting the details of how they implemented such a program. If it is determined that individual laboratories will prepare their own, see Table 19 for possible sources of standards.

TABLE 9

STANDARD QC FORMAT (example)

Parameter Name - Matrix
Normal Detection Limit: 10 ppb

Date	Sample #*	Measured Value	Amount Added	Percent Recovery
10/11	1234	40	0	-
10/11	1234R	60	0	-
10/11	1234SS	75	50	50
10/11	1234SB	45	50	90
10/11	1234MB	<10	0	-
10/11	1234FB	<10	0	-

Percent Recovery from Sample: $\overline{P} \pm 3 S_p =$
Percent Recovery from Blank: $\overline{P} \pm 2 S_p =$
Critical Differences between Replicate Analyses:

*R = replicate; SS = standard addition to sample; SB = standard addition to blank; MB = method blank; FB = field blank

TABLE 10

SURROGATE RECOVERY FORMAT (example)

Surrogate Name - Matrix
Normal Detection Limit:

Date	Sample #	Measured Value	Amount Added	Percent Recovery
10/11	1234	40	50	80
10/11	1235	60	50	120

Percent Recovery from Samples: $\overline{P} \pm 3 S_p =$
Percent Recovery from Blanks: $\overline{P} \pm 2 S_p =$

TABLE 11

PURGEABLE FRACTION
MATRIX EFFECT SPIKE

Compound		Approx. Conc. in Spike (ppb)
(1)	Acrolein	240
(2)	Acrylonitrile	110
(3)	Benzene	20
(4)	Bromodichloromethane	20
(5)	Bromoform	60
(6)	Bromomethane	60
(7)	Carbon Tetrachloride	20
(8)	Chlorobenzene	20
(9)	Chlorodibromomethane	20
(10)	Chloroethane	60
(11)	2-Chloro(ethyl vinyl) ether	60
(12)	Chloroform	20
(13)	Chloromethane	60
(14)	Dichlor difluoromethane	60
(15)	1,1-Dichloroethane	20
(16)	1,2-Dichloroethane	20
(17)	1,1-Dichloroethylene	20
(18)	Trans-1,2-Dichloroethylene	20
(19)	Dichloromethane	20
(20)	1,2-Dichloropropane	20
(21)	Cis-1,3-Dichloropropene	20
(22)	Trans-1,3-Dichloropropene	20
(23)	Ethylbenzene	20
(24)	1,1,2,2-Tetrachloroethane	60
(25)	Tetrachloroethylene	20
(26)	Toluene	20
(27)	1,1,1-Trichloroethane	20
(28)	1,1,2-Trichloroethane	20
(29)	Trichloroethylene	20
(30)	Trichlorofluoromethane	20
(31)	Vinyl Chloride	60

TABLE 12

PURGEABLE FRACTION
SURROGATE SPIKE

Compound	Approx. Conc. in Spike (ppb)
d_6 benzene	30
d_8 toluene	30
d_{10} ethylbenzene	30
bromochloromethane	20
1,4-dichlorobutane	20
1-chloro-2-bromopropane	20

TABLE 13

ACID FRACTION
MATRIX EFFECT SOLUTION

Compound		Approx. Conc. Range of Spike (ppb)
(1)	2-Chlorophenol	20 - 30
(2)	p-Chloro-m-cresol	40 - 60
(3)	2,4-Dichlorophenol	20 - 30
(4)	2,4-Dimethylphenol	30 - 120
(5)	4,6-Dinitro-o-cresol	900 - 3600
(6)	2,4-Dinitrophenol	1600 - 6400
(7)	2-Nitrophenol	40 - 160
(8)	4-Nitrophenol	500 - 2000
(9)	Pentachlorophenol	100 - 400
(10)	Phenol	20 - 30
(11)	2,4,6-Trichlorophenol	40 - 160

TABLE 14

ACID AND BASE/NEUTRAL SURROGATE SPIKE

Compound	Approx. Conc. in Spike (ppb)
decafluorobiphenyl	50
pentafluorophenol	100
4-fluoroaniline	100

TABLE 15

BASE/NEUTRAL
MATRIX EFFECT SPIKE

	Compound	Approx. Conc. Range of Spike (ppb)
Mixture 1:	1,3-dichlorobenzene	10 - 400
	1,2-dichlorobenzene	10 - 400
	hexachlorobutadiene	10 - 400
	napthalene	10 - 400
	acenapthene	10 - 400
	fluorene	10 - 400
	2,4-dinitrotoluene	30 - 1200
	hexachlorobenzene	10 - 400
	anthracene	10 - 400
	diethylphthalate	20 - 800
	pyrene	10 - 400
	crysene	20 - 800
	benzo(a)anthracene	20 - 800
Mixture 2:	1,4-dichlorobenzene	10 - 400
	bis(2-chloroisopropyl)ether	20 - 800
	bis(2-chloroethyl)ether	10 - 400
	nitrobenzene	10 - 400
	acenapthylene	10 - 400
	2,6-dinitrotoluene	30 - 1200
	4-bromophenyl-phenyl ether	20 - 800
	dimethylphthalate	10 - 400
	di-N-butylphthalate	10 - 400
	bis(2-ethylhexyl)phthalate	10 - 400
	3,3'-dichlorobenzidine	40 - 1600
Mixture 3:	benzidine	40 - 1600
	benzo(g,h,i) perylene	20 - 800
	N-nitrosodimethylamine	30 - 1200
	di-n-octylphthalate	20 - 800
Mixture 4:	hexachloroethane	10 - 400
	N-nitroso-di-N-propylamine	30 - 1200
	1,2,4-trichlorobenzene	10 - 400
	hexachlorocyclopentadiene	20 - 800
	2-chloronapthylene	10 - 400
	isophorone	40 - 1600
	1,2-diphenylhydrazine	20 - 800
	N-nitrosodiphenylamine	20 - 800
	phenanthrene	10 - 400
	fluoranthene	10 - 400
	butylbenzylphthalate	20 - 800

TABLE 16

PESTICIDE FRACTION
MATRIX EFFECT SPIKE

	Compound	Approx. Conc. Range of Spike (ppb)
Mixture 1:	a-BHC	0.1 - 0.5
	g-BHC	0.1 - 0.5
	d-BHC	0.2 - 1
	Heptachlor	0.2 - 1
	Heptachlor epoxide	0.2 - 1
	a-endosulfan	0.3 - 1.5
	dieldrin	0.3 - 1.5
	endrin	0.5 - 2.5
	p,p'-DDD	0.6 - 3.0
Mixture 2:	β-BHC	0.1 - 0.5
	Aldrin	0.2 - 1.0
	p,p'-DDE	0.4 - 2
	β endosulfan	0.6 - 30
	p,p'-DDT	1 - 5
Mixture 3:	Tech grade chlordane	2 - 10
Mixture 4:	Toxaphene	30 - 150
Mixture 5:	PCB 1254	4 - 20

TABLE 17

METALS FRACTION
MATRIC EFFECT SPIKE

Compound		Approx. Conc. Range of Spike (ppb)
Flame:*	Beryllium	1 - 10
	Cadmium	5 - 50
	Chromium	5 - 50
	Copper	5 - 50
	Nickel	5 - 50
	Silver	5 - 50
	Zinc	5 - 50
Flameless:*	Antimony	1 - 10
	Arsenic	0.5 - 5
	Lead	1 - 10
	Selenium	1 - 10
	Thallium	1 - 10
Cold Vapor:	Mercury	0.2 - 2

*Either flame or flameless method may be used depending on concentrations of metals - typical distribution is given.

TABLE 18

CONVENTIONAL FRACTION
MATRIX EFFECT SPIKE

Material	Approx. Conc. of Spike (ppb)
CN^-	10 - 100
Phenol	10 - 100

TABLE 19

POSSIBLE SOURCES OF STANDARDS

Aldrich Chemical Co., Milwaukee, Wisc.

Analabs, Inc., North Haven, Conn.

J.T. Baker Chemical Co., Phillipsburgh, N.J.

Chemical Procurement Laboratories, College Point, N.Y.

Columbia Organics Catalog A-7, Columbia, S.C.

Eastman Kodak Co., Rochester, N.Y.

K&K Rare & Fine Chemicals, Plainview, N.Y.

Nanogens International, P.O. Box 487, Freedom, CA 95019

"Analytical Reference Standards and Supplemental Data for Pesticides and Other Selected Organic Compounds," EPA-660/9-76-012 (May 1976), Health Effects Research Laboratory, Environmental Toxicology Division, Research Triangle Park, N.C.

R.K. Chemical Co., 2135 Howard Street, Hartville, OH 44632

Tridom Chemical Inc., Hauttauge, N.Y.

PCR Research Chemicals, Inc., Gainesville, Fla.

Supelco, Inc., Bellefonte, PA.

Chem Service, West Chester, PA.

Polyscience, Warrenton, PA.

Applied Science Laboratories, State College, PA.

NOTE: These sources are not to be interpreted as being endorsed by the EPA.

C. Region VII Stock Solution Supply Program

Summary

The contractor shall run one duplicate (same sample run twice), one reagent blank (laboratory prepared distilled/deionized water), one method standard (standard added to distilled/deionized water), and one matrix effect spike (standard added to sample) for each batch of samples collected at a given city. A field reagent blank will also be collected and should be treated as a regular sample. Therefore, the laboratory should receive 15 samples from the field for each city. Twelve of these will be regular samples, one will be a field blank, one will be a duplicate sample for the duplicate analyses and the remaining sample will be a duplicate for the matrix effect spike.

Region VII will supply two types of quality control solutions to each contractor. The first type of solution is called a surrogate stock solution. These stock solutions contain non priority pollutant compounds and are used to detect gross problems in sample work-up. The second type of solution is called a standard stock solution. These solutions contain most of the priority pollutantsand are used to estimate the reliability of reported data. The quality control solutions provided will be as follows:

Surrogate Solutions	
Volatiles	2
Extractables (acids, base & neutral)	1
TOTAL	4

Standard Stock Solution	
Volatiles	5
Base Neutral	4
Acid	1
Pesticide	5
Metals	1
TOTAL	16

Each day samples are started, the contractor should transfer an aliquote (specific volume will be supplied with solution) from each surrogate stock solution to a volumetric and dilute to volume. An aliquote of this surrogate working solution is then added to each sample just prior to analyses.

The volatile standard additons are prepared by combining the 5 volatile stocks, into one volumetric, diluting to volume, and spiking the resulting solution into the blank water or into a sample. The 4 base/neutral stocks and the 1 acid stock are combined in a similar manner. Of the 5 pesticide stocks only 1 is used for spiking purposes at any one time. These should be rotated so that all the pesticides eventually are included in the quality assurance program. One metal solution will be provided which will be added directly, without prior dilution, to the sample or blank water.

These procedures are explained in more details in the following pages. Please refer any questions to Dr. Robert Kleopfer (816-374-4285).

INSTRUCTIONS FOR USE OF REGION VII SPIKING SOLUTIONS

Region VII has provided standard spiking solutions and surrogate spiking solutions. These are to be used according to the following instructions per each analytical group and the results are to be reported on the attached quality assurance report sheet (one sheet per compound). Each set of samples processed should include one method blank, one method standard at one spiking level (spiked blank water - wait one hour), and one matrix effect spike at one level (spiked sample - wait one hour), and one field duplicate. All samples are to be spiked with surrogate solutions as instructed.

In order to eliminate errors caused by inconsistencies in true spiking solution concentrations, we suggest that the spiking solutions also be used as quantitation standards in determination of recovery values. This can be done readily by preparing a reference standard at the same time that a sample is spiked. For example, if 0.2ml of a spiking solution is dosed into 1 liter of water sample, extracted and then concentrated to 1 ml, then that same spiking solution should be used as the standard by taking 0.2ml and adjusting to 1 ml in volume.

Preparation of Base/Neutral Spiking Solutions for Matrix Effect and Method Standard

I. General Comments

A. The contractor is provided with four B/N mixes. The spiking solution is prepared by mixing equal volumes of each of the four mixes together.

B. Spiking levels for the B/N compounds are .2, .4, .6, 1, 2, 4, and 8 mls of the spiking solution.

II. B/N Mix I

A. Stock Solution

1. Mix I was made up in 10% benzene in methylene chloride.
2. Concentrations of components in stock:

Compound	Concentration
1,3 dichlorobenzene	200 μg/ml
1,2 dichlorobenzene	200 μg/ml
hexachlorobutadiene	200 μg/ml
napthalene	200 μg/ml
acenapthene	200 μg/ml
fluorene	200 μg/ml
2,4 dinitrotoluene	600 μg/ml
hexachlorobenzene	200 μg/ml
anthracene	200 μg/ml
diethylphthalate	400 μg/ml
pyrene	200 μg/ml
chrysene	400 μg/ml
benzo(a)anthracene	400 μg/ml

B. Spiking Solution

1. After diluting Mix I with equal volumes of the other three compounds, the concentrations will then be 1/4 of the values just reported.

III. B/N Mix II

A. Stock Solution

1. Mix II was made up in 10% benzene in methylene chloride.
2. Concentration of components in stock:

Compound	Concentration
1,4 dichlorobenzene	200 µg/ml
bis (2 chloroisopropyl) ether	400 µg/ml
bis (2-chloroethyl) ether	200 µg/ml
nitrobenzene	200 µg/ml
acenapthylene	200 µg/ml
2,6 dinitrotoluene	600 µg/ml
4-bromophenyl-phenyl ether	400 µg/ml
dimethylphthalate	200 µg/ml
di-N-butylphthalate	200 µg/ml
bis (2-ethylhexyl) phthalate	200 µg/ml
3,3'dichlorobenzidine	800 µg/ml

B. Spiking Solution

1. All above concentrations will be quartered after spiking solution is made up.

IV. B/N Mix III

A. Stock Solution

1. Mix III is made up in 10% benzene in methylene chloride.
2. Concentrations of components in stock:

Compounds	Concentration
benzidine	800 µg/ml
benzo(g,h,i) perylene	400 µg/ml
N-nitrosodimethylamine	600 µg/ml
di-n-octylphthalate	400 µg/ml

B. Spiking Solution

1. After diluting Mix III with equal volumes of the other three mixes, the above concentrations will be quartered.

V. B/N Mix IV

A. Stock Solution

1. Mix IV is made up in 10% benzene in methylene chloride.
2. Concentrations of components in stock:

Compounds	Concentration
hexachloroethane	200 µg/ml
N-nitroso-di-N-propylamine	600 µg/ml
1,2,4-trichlorobenzene	200 µg/ml
hexachlorocyclopentadiene	400 µg/ml

Compounds	Concentration
2-chloronapthylene	200 μg/ml
isophorone	800 μg/ml
1,2 diphenylhydrazine	400 μg/ml
N-nitrosodiphenylamine	400 μg/ml
phenanthrene	200 μg/ml
fluoranthene	200 μg/ml
butylbenzylphthalate	400 μg/ml

B. Spiking Solution

1. The above concentrations will be quartered.

Preparation of Pesticide Spiking Solutions for Matrix Effect Spike and Method Standard

I. General Comments

A. There are five pesticide stock solutions. When the spike solutions are made up from these stocks, only one of the solutions is spiked at a time. Otherwise pesticide peaks will overlap on a GC run. So when a certain pesticide is suspected to be present in an unknown, spike with the mix containing that pesticide.

B. All spiking levels for the pesticides are the same. 1, 2, 3, 4, or 5 mls of spiking solution should be pipetted into 1 liter of sample (matrix effect spike) or into 1 liter of organic free deionized water (method standard).

II. Pesticide Mix I

A. Stock Solution

1. The contractor is provided with a 100X concentrated stock solution. This stock solution is made up in hexane.

B. Spiking Solution

1. Preparation

a. Make a 1/100 dilution on the stock solution into either hexane or iso-octane. Be sure all solvents used are pesticide quality.

2. Concentrations of compounds present in 1/100 dilution:

Compound	Concentration
a-BHC	100 pg/µl
g-BHC	100 pg/µl
d-BHC	200 pg/µl
Heptachlor	200 pg/µl
Heptachlor epoxide	200 pg/µl
a-endosulfan	300 pg/µl
dieldrin	300 pg/µl
endrin	500 pg/µl
p,p' DDD	600 pg/µl

III. Pesticide Mix II

A. Stock Solution

1. Stock solution provided is 100X as concentrated as the spiking solution to be used, and is in hexane.

B. Spiking Solution

1. Preparation

a. Make a 1/100 dilution of the stock provided into either hexane or iso-octane. Be sure to use pesticide grade solvents.

2. Concentrations of compounds in spiking solution:

Compound	Concentration
β-BHC	100 pg/µl
Aldrin	200 pg/µl
p,p' DDE	400 pg/µl
β endosulfan	600 pg/µl
p,p' DDT	1 ng/µl

IV. Pesticide Mix III

A. Stock Solution

1. Stock solution provided to contractors is 10X as concentrated as spiking solution to be used.

B. Spiking Solution

1. Preparation

a. Make a 1/10 dilution of stock solution into hexane or iso-octane.

2. Concentration in mix after 1/10 dilution:

Mixture	Concentration
tech. grade chlordane	2 ng/µl

V. Pesticide Mix IV

A. Stock Solution

1. Stock solution provided is 10X as concentrated as spiking solution to be used and is in hexane.

B. Spiking Solution

1. Preparation

a. Make a 1/10 dilution of stock solution provided into either hexane or iso-octane (pesticide grade quality).

2. Concentration in spiking solution:

Mixture	Concentration
toxaphene	30 ng/µl

VI. Pesticide Mix V

A. Stock Solution

1. Contractors are provided with a 10X concentrated solution in hexane.

B. Spiking Solution
    1. Preparation
        a. Make a 1/10 dilution of stock solution provided into either hexane or iso-octane (pesticide grade quality).
    2. Concentration in spiking solution:

Mixture	Concentration
PCB-1254	4 ng/μl

B

Base/Neutral - Acid Surrogate Spiking Solution

I. Stock

A. The surrogate stock solution provided to the contractor contains decafluorobiphenyl, pentafluorophenol, and 4-fluoroaniline. It is made up in 10% benzene in methylene chloride.

B. Concentrations of compounds in stock.

Compound	Concentration
decafluorobiphenyl	.5 mg/ml
pentafluorophenol	1 mg/ml
4-fluoroaniline	1 mg/ml

II. Spiking Levels

A. The stock solution provided is also the spiking solution.

B. 100 µe of this stock or spiking solution is spiked into every sample including quality control samples.

9

Preparation of Acid Solution for Matrix Effect Spike and Method Standard

I. Acid Mix

A. Stock

1. There is only one acid stock and it is in methylene chloride.

2. The stock solution is 10X as concentrated as the spiking solution to be used.

B. Spiking Solution

1. Preparation

a. Make a 1/10 dilution of the stock in methylene chloride.

2. Spiking Levels

a. 2, 4, 6, or 8 mls of the spiking solution is spiked into 1 liter of sample (matrix effect spike) or 1 liter of organic free D.I. H_2O (method spike).

3. Concentration of components in spiking solution.

Compound	Concentration
2-nitrophenol	20 µg/ml
2-chlorophenol	10 µg/ml
2,4 dimethylphenol	15 µg/ml
phenol	10 µg/ml
2,4,6 trichlorophenol	17 µg/ml
2,4 dichlorophenol	12 µg/ml
p-chloro-n-cresol	18 µg/ml
pentachlorophenol	55 µg/ml
2,4 dinitrophenol	800 µg/ml
4-nitrophenol	250 µg/ml
4,6 dinitro-o-cresol	450 µg/ml

Preparation of Surrogate Spike Solutions to be Used for Volatile Organics

A. Reagents

1. D_6 benzene
2. D_8 toluene
3. D_{10} ethylbenzene
4. Supelco Mix - Catalog #4-8823 contains 20mg/ml each in 1 ml MeOH, contains bromo-chloromethane, 1.4 dichlorobutane and 1-chloro-2-bromopropene.
5. Reagent grade methanol
6. Organic free water

B. Apparatus

1. Volumetric flasks, clean and baked out at 180°C and cooled, 10ml and 25ml in size.
2. Hamilton syringe - gas tight, 100µl size.

C. Preparation of Deuterated Stock Solution

1. Into a clean 25ml volumetric flask carefully add about 15ml MeOH.
2. Add 100µl D_6 benzene.
3. Add 100µl D_8 toluene.
4. Add 100µl D_{10} ethylbenzene.
5. Dilute to volume with MeOH.
6. Stopper, mix well, store in a protected atmosphere in a refrigerator.

Approximate concentrations of deuterated stock solutions:

D_6 benzene = 3515 ppm
D_8 toluene = 3468 ppm
D_{10} ethylbenzene = 3469 ppm

D. Preparation of Working Surrogate Spike Solution

1. Into a 10ml volumetric flask that contains 10ml organic free water, add 80µl deuterated stock solution.
2. Add 10µl Supelco surrogate spike solution.
3. Mix by inverting three times.
4. Add 5µl of surrogate spike solution to each 5ml sample being analyzed by purge and trap followed by GC/MS.
5. Record total ion content for each spike and monitor spikes throughout the day.

Concentration of spikes are approximate.

D_6 benzene = 28 ppb
D_8 toluene = 28 ppb
D_{10} ethylbenzene = 28 ppb
bromochloromethane = 20 ppb
1,4 dichlorobutane = 20 ppb
1-chloro-2-bromopropene = 20 ppb

Preparation of Volatile Organic Standards

Due to the nature (volatile organic compounds) and the number (31), the standard reference mix for volatile organics is prepared by using the Supelco purgable mixes as stock solutions.

Stock Solutions:

A. Purgable A, catalog #4-8815, each constituent at 0.2 mg/ml in methanol. From Supelco. Contains the following: Methylene chloride, trichloroethylene, 1,1,-dichloroethylene, 1,1-dichloroethane, 1,1,2-trichloroethane, dibromochloromethane, chloroform, tetrachloroethylene, carbon tetrachloride, chlorobenzene, 1,2-dichloropropane.

B. Purgable B, catalog #4-8816, each constituent at 0.2 mg/ml in methanol. Obtained from Supelco. Contains the following: Trichlorofluoromethane, cis-1,3-dichloropropene, benzene, trans-1,2-dichloroethylene, 1,2-dichloroethane, bromodichloromethane, toluene, trans-1,3-dichloropropene, ethylbenzene.

C. Purgable C, catalog #4-8817, each constituent at 0.2 mg/ml in methanol. Obtained from Supelco. Contains the following: Chloromethane, dichlorodifluoromethane, bromomethane, vinylchloride, chloroethane.

D. Acrolein stock, accurately weigh about 800mg into a 100ml volumetric flask which contains about 75ml MeOH. Dilute to volume with methanol (conc. 6.08 mg/ml supplied).

E. Acrylonitrile stock, accurately weigh about 1.6g into a 100ml volumetric flask which contains about 75ml MeOH. Dilute to volume with methanol (conc. 11.181 mg/ml supplied).

F. 2-Chloroethylvinylether stock, accurately weigh about 100mg into a 10ml volumetric flask containing MeOH. Dilute to volume with methanol (conc. 11.6 mg/ml supplied).

Working Standard

Into a 2ml screw cap vial, which has been baked out at 180°C for one hour and allowed to cool, add:

1. 100µl MeOH
2. 200µl Purgable A
3. 200µl MeOH
4. 200µl Purgable B
5. 200µl MeOH
6. 600µl Purgable C
7. 100µl MeOH
8. 20µl Acrylonitrile stock
9. 100µl MeOH
10. 80µl Acrolein stock
11. 100µl MeOH

12. 10µl 2-chloroethylvinyl ether stock
13. 90µl MeOH

Quickly add each. Do not let needle of syringe below the surface of the solvent. Touch sides of vial for draining. Label carefully. Stopper tightly. Store in freezer under activated charcoal. Amounts may be halved depending on need. Prepare working standard monthly.

5µl or working standard is spiked into 5ml deionized water which is then analyzed by purge and trap and GC/MS. This (5µl) represents a spike having the following composition:

Compound	Amount (µg/l in ppb)
Purgable A group	20
Purgable B group	20
Purgable C	60
Acrolein	243
Acrolynitrile	112
2-chloroethylvinyl ether	58

IV PERFORMANCE CRITERIA

A. Introduction

The data generated for each fraction was compared at an EGD meeting in Norfolk, Va. The data represent 10,000 points and were primarily generated by the following laboratories:

1. ADL Inc., Cambridge, Ma.
2. Carborundum Co., Sacramento, Ca.
3. EPA-Region VII, Kansas City, Kansas
4. Versar Inc., Springfield, Va.

Smaller amounts of data were developed at three other laboratories for a total of seven participants. The samples that were spiked with matrix effect and surrogates range from ground water to POTW effluents and timber and paper product waste.

The data can be used to develop a set of control limits, both Upper Control Limits (UCL) and Lower Control Limits (LCL) for priority pollutant analysis. Sufficient data is presented to evaluate both the operation of the laboratory via method spikes and blanks and the impact of a particular matrix via the duplicate spikes. The base data generated represent vastly varying conditions and matrices and is quite useful. Most control limits would be expected to decrease, i.e., improve, as methods are improved and laboratory experience is gained.

B. Summary of Control Limits for Matrix Effect Spikes

The data and tables are directly from the Region VII presentation and are to be used as control limit guides.

$$UCL = 3\ S_p$$
$$LCL = 3\ S_p$$

For example, consider the method spike for benzene (data from Table 21).

	In the Method Standard	In the Matrix Spike
	89 12	93 24
UCL	89 + 3(12) = 125	93 + 3(24) = 165
LCL	89 - 3(12) = 53	93 - 3(24) = 21

Therefore, within a given set of samples and control solutions, a recovery for benzene in the method standard between 53% - 125% or in the matrix spike between 21% - 165% is said to be in control. Any data outside these limits need careful examination and probable re-analysis. The Tables 20 through 25 give all data relevant to matrix spike recovery.

C. Summary of Control Limits for Surrogate Spikes

The priority pollutant surrogates are presented in Table 26. The data base upon which to make decisions is much smaller here than for the matrix effect spike. In practice, the data generated by surrogates gives the analyst a real-time instantaneous look at the operation of the overall analytical system in every sample. This instantaneous information is the most important reason for the retention of the surrogates.

For the longer term record, the upper and lower control limits are calculated in the same way as for matrix effect spikes.

TABLE 20. INTRALABORATORY COMPARISON[a]

Priority Pollutant Fraction[b]	LAB I	LAB II	LAB III	LAB IV	LAB V	LAB VII	Average[c]
Volatile (MS)	88±21	95±5	-	100±8	-	-	90±13
Volatile Sample Spike	82±24	101±9	93±13	107±9	-	-	92±15
Acid (MS)	90±18	89±5	-	67±14	82±16	-	84±13
Acid Sample Blank	92±34	72±10	62±12	60±15	84±17	-	76±19
B/N-(MS)	95±25	78±41	-	77±15	-	-	84±25
B/N Sample Spike	84±18	61±22	55±24	68±16	-	63±13	68±21
Pesticide (MS)	73±8	74±19	-	88±8	-	-	78±11
Pesticide Sample Spike	69±7	51±18	33±10	93±5	-	-	59±11
Metals (MS)	113±37	-	-	103±8	-	-	108±22
Metals Sample Spike	100±20	103±14		92±7	-	-	96±11
Cyanide (MS)	103±14	-	-	103±8	-	-	103±7
Cyanide Sample Spike	101±12	-	-	93±16	-	-	96±14
Phenolics (MS)	10±13	97±6	-	100±7	-	-	101±8
Phenolics Sample Spike	93±15	98±10	-	97±9	-	-	96±11

a) The values are in units of percent recovery (P) plus or minus (±) one standard deviations (Sp).

b) MS refers to the method standard or the standard addition to blank water. Sample spike refers to the standard addition to a sample.

c) P and Sp are weighted averages based on the number of data points contributed by each laboratory.

TABLE 21. PURGEABLE ORGANICS[a]

Compound	Method[b] Standard	Standard[c] Spike
Acrolein	77±30	32±30
Acrylonitrile	96±31	102±28
Benzene	89±12	93±24
Bromodichloromethane	97±11	103±31
Bromoform	94±14	88±12
Bromomethane	90±16	78±15
Carbon Tetrachloride	91±23	91±33
Chlorobenzene	94±23	103±24
Chlorodibromomethane	86±12	99±17
Chloroethane	67±22	60±23
Chloroform	90±18	91±26
Chloromethane	91±22	64±28
Dichlorodifluoromethane	108±11*	114±8*
1,1-Dichloroethane	83±10	87±21
1,2-Dichloroethane	102±12	103±27
1,1-Dichloroethylene	74±24	80±32
trans-1,2-Dichloroethylene	90±25	85±35
Dichloromethane	82±46	66±66
1,2-Dichloropropane	94±26	99±30
cis-1,3-Dichloropropene	95±15	98±20
trans -1-3-Dichloropropene	91±13	93±16
Ethylbenzene	109±19	106±28

Continuation of Table 21

Compound	Method Standard	Sample Spike
1,1,2,2-Tetrachloroethane	81±31	78±31
Tetrachloroethylene	97±13	99±26
Toluene	96±22	97±25
1,1,1-Trichloroethane	92±21	94±36
1,1,2-Trichloroethane	102±14	103±19
Trichloroethylene	106±14	110±22
Trichlorofluoromethane	59±23	67±48
Vinyl Chloride	103±30	79±22

a) The values are in terms of P ± Sp. Data from 2-4 laboratories have been averaged except where noted with an (*) asterik. In general the concentration added ranged from 10 to 1000 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.

*Data from only one lab were available.

TABLE 22. ACID FRACTION[a]

COMPOUND	METHOD[b] STANDARD	SAMPLE[c] SPIKE
2-Chlorophenol	80±22	71±23
4-Chloro-3-methylphenol	96±16	99±19
2,4-Dichlorophenol	86±24	84±23
2,4-Dimethylphenol	71±19	72±16
4,6-Dinitro-o-cresol	87±34	102±23
2,4-Dinitrophenol	89±22	92±40
2-Nitrophenol	95±22	87±22
4-Nitrophenol	65±33	59±46
Pentachlorphenol	87±24	84±22
Phenol	61±11	54±24
2,4,6-Trichlorphneol	91±22	80±24

a) The values are in terms of P ± Sp. Data from 2-5 laboratories have been averaged. In general the concentation added ranged from 20 to 2500 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.

TABLE 23. BASE/NEUTRAL FRACTION[a]

Compound	Method[b] Standard	Sample[c] Spike
Acenaphthene	90±22	78±24
Acenapthylene	83±22	79±27
Anthracene[d]	98±20	79±25
Benzidine	44±27	40±29
Benzo(a)anthracene[e]	105±33	51±24
Benzo(b)fluoranthene[f]	96±68*	41±21
Benzo(k)fluoranthene[f]	96±68	47±27
Benzo(a)pyrene	90±22	43±21
Benzyl Butyl Phthalate	49±39	49±22
Bis(2-chloroethyl) Ether	98±48	80±49
Bis(2-chloroisopropyl) Ether	154±136	96±88
Bis(2-ethylhexyl) Phthalate	70±33	66±50
4-Bromophenyl Phenyl Ether	80±25	63±25
2-Chloronaphthalene	88±20	79±21
Chrysene[e]	105±33	77±27
Dibenzo(a,h)anthracene	80±42	36±29
Di-n-butyl Phthalate	80±32	58±27
1,2-Dichlorobenzene	65±24	65±27
1,3-Dichlorobenzene	67±21	62±20
1,4-Dichlorobenzene	67±22	63±21
3,3'-Dichlorobenzidine	71±35	62±45

Continuation of Table 23

Compound	Method[b] Standard	Sample[c] Spike
Diethyl Phthalate	71±37	65±37
Dimethyl Phthalate	43±37	66±43
2,4-Dinitrotoluene	122±55	94±45
2,6-Dinitrotoluene	115±41	104±35
Di-n-octyl Phthalate	84±44	88±32
1,2-Diphenylhydrazine (and/or Azobenzene)	97±26	91±32
Fluoranthene	111±26	63±20
Fluorene	98±24	88±25
Hexachlorobenzene	98±31	76±31
Hexachlorobutadiene	76±26	77±45
Hexachlorocyclopentadiene	38±28	27±10
Hexachloroethane	63±22	58±23
Isophorone	66±36	67±22
Indeno(1,2,3-cd)pyrene	109±14	40±21
Naphthalene	83±24	89±51
Nitrobenzene	106±31	77±51
N-nitrosodipheylamine (and/or Diphenylamine)	72±22	66±25
N-Nitrosodi-*n*-propylamine	86±34	71±22
Phenanthrene	98±20	79±20
Pyrene	142±41	63±20
1,2,4-Trichlorobenzene	74±22	69±24

a) The values are in terms of P ± Sp. Data from 2-5 laboratories have been averaged except where noted with an (*) asterik. In general the concentration added ranged from 10 to 500 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
d,e,f) These isomers pairs are not separted by packed column GC. Also mass spect data are not sufficiently unique to allow differentiation.
*Data from only one lab were available.

TABLE 24. PESTICIDE FRACTION[a]

Compound	Method[b] Standard	Sample[c] Spike
Aldrin	72±13	55±12
alpha-BHC	78±13	55±12
beta-BHC	79±21	57±22
gamma-BHC	78±14	64±11
delta-BHC	82±16	61±16
Chlordane	81±17*	39±9*
4,4'-DDD	82±14	62±16
4,4'-DDE	76±14	57±18
4,4'-DDT	85±17	76±26
Dieldrin	71±14	62±16
Endosulfan I	65±14	61±13
Endosulfan II	67±19	66±14
Endosulfane Sulfate	74±39*	84±30*
Endrin	82±25	68±18
Endrin Aldehyde	64±76*	34±39*
Heptachlor	72±12	49±12
Heptachlor Epoxide	82±14	65±11
PCB	83±11*	42±13
Toxaphene	89±12*	-

a) The values are in terms of P ± Sp. Data from 2-4 laboratories have been averaged except where noted with an (*)asterik. In general the concentration added ranged from 0.1 to 100 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
*Data from only one lab were available.

TABLE 25. METALS, CYANIDE, AND PHENOLICS[a]

PARAMETER	METHOD[b] STANDARD	SAMPLE[c] SPIKE
Antimony	61±47*	103±24
Arsenic	120±20	97±25
Beryllium	89±16	94±20
Cadmium	91±18	98±23
Chromium	99±30	106±25
Copper	136±70	99±24
Lead	116±32	93±25
Mercury[d]	83±24	79±38
Nickel	84±62	101±26
Selenium	112±15	93±20
Silver	110±25	80±25
Thallium	99±33*	95±23
Zinc	122±44	106±37
Cyanide	103±7	96±14
Total Phenols	101±8	96±11

a) The values are in terms of P ± Sp. Data from 2-3 laboratories have been averaged exept where noted with an (*) asterik. In genral the concentration added ranged from 10 to 1000 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
d) Analyzed by the cold vapor technique.

*Data from only one lab were available.

TABLE 26. PRIORITY POLLUTANT SURROGATES[a]

Compound	LAB III[b]	LAB IV[c]	LAB VIII[d]
(Purgeable Orgnaics)			
d_6-Benzene	-	93±22	-
Bromochloromethane	-	91±20	-
d-Chloroform	139±96	-	-
1,4-Dichlorobutane	-	85±24	-
d_4-1,2-Dichloroethane	119±29	-	-
d_2-Dichloromethane	146±55	-	-
d_{10}-Ethylbenzene	102±25	94±18	-
Fluorbenzene	96±20	-	-
d_8-Toluene	-	92±18	-
d_3-1,1,1-Trichloroethane	117±41	-	-
(Acids)			
2-Fluorphenol	76±36	-	-
Pentafluorphenol	84±30	50±22	101±39
d_5-Phenol	55±20	-	-
Trifluoro-m-cresol	72±42	-	-
(Base/Neutral)			
Decafluorobiphenyl	39±18	41±29	46±13
d_8-Nepthalene	76±22	-	-
2-fluornaphthelene	75±20	-	-
1-fluronaphthelene	69±18	-	-
d_{12}-benzo(a)anthracene	68±16	-	-
2-flurobiphenyl	63±5	-	-
d_5-aniline	57±36	-	-

Continuation of Table 26

Compound	LAB III[b]	LAB IV[c]	LAB VIII[d]
2-fluroaniline	74±39	-	-
d_5-nitrobenzene	70±21	-	-

a) The values are in terms of P ± Sp. The concentration added ranged from 20 to 200 parts per billion.

b) The matrix for these surrogates included influent and effluent samples from 12 different industrial categories.

c) The matrix for these surrogates included POTW, detergent, and chemical disposal industries.

d) The matrix for these surrogates included POTW samples only.

SECTION IV

2/25/80
4-3-80

PRIORITY POLLUTANT METHODOLOGY

QUALITY ASSURANCE REVIEW

Robert D. Kleopfer*
Jerry R. Dias and
Billy J. Fairless

United States Environmental Protection Agency
Region VII Laboratory
25 Funston Road
Kansas City, Kansas 66115

ABSTRACT

Initial quality assurance statistics are presented for the priority pollutants. The statistics are based on over 10,000 data points contributed by seven laboratories. The average recovery of all the organic prioirty pollutants from industrial effluents is 73 per cent with a standard deviation of 26 per cent. Data are summarized for metals, cyanides, phenolics, and the specific organic compounds which are divided into four fractions. Recommended control limits are given along with a summary of data for surrogate recoveries. The results have permitted identification of the variables associated with EPA's analytical protocol.

INTRODUCTION

In compliance with a consent decree emanating from civil court actions brought against the Environmental Protection Agency (EPA) by concerned organizations, EPA has developed a list of 129 priority pollutants with the goal of establishing industrial effluent limitations and guidelines.[1] This paper will summarize the results of over 10,000 measurements collected by seven laboratories on 104 of the 114 organic priority pollutants, all the metals (13), and total phenol and cyanide. (Actually there are 130 priority pollutants if one differentiated 1,3-dichloropropene into cis and trans isomers.) The seven different Aroclors are reported collectively as PCB's while three base/neutral compounds, two volatile orgnaic compounds, and asbestos are not included in this report. The data assembled herein has permitted identification of probable problem areas and provides an initial estimate of the accuracy and precision of the EPA analytical methodology[2] for the priority pollutants.

Analytical Methodology

The screening of wastewater for 114 organics is accomplished by analyses of five different fractions.[2] The fractions are pesticides (26 compounds), base/neutrals (46 compounds), acids (11 phenols), purgeables (29 volatile organics), and direct aqueous injection fraction (2 compounds).

The base/neutrals (B/N) include compounds such as 1,4-dichlorobenzene, benzidine, and benzo(a)pyrene. These compounds are extracted from basic aqueous solution with methylene chloride. The concentrated extracts, are analyzed by GC/MS on a 1% SP-2250 column. Columns packed with 3% OV-17 and 3% SP-2250-DB have also been used effectively.

The acid fraction (A) consists of 11 phenols ranging from phenol itself to pentachlorophenol. These are determined by extraction of acidic solution with methylene chloride and analysis by GC/MS techniques. The preferred column packing for this analysis is 1% SP-1240-DA.

The pesticide fraction (P) is prepared by extraction with 15% methylene chloride in hexane. The pesticides are initially screened by gas chromatography with electron capture detection.[3] Any compounds which are tentatively identified by that technique must be confirmed by GC/MS.

The purgeable organics, which include compounds ranging in volatility from methyl chloride to ethyl benzene, are measured using a purge and trap analytical technique. In this method, the volatile organics are swept from 5ml of sample with an inert gas. The purged organics are retained on a trap consisting of Tenax GC and Silica Gel. These organics are then heat desorbed onto an analytical column consisting of 0.2% Carbowax 1500 on Carbopak C with a 3% Carbowax 1500 precolumn. Again, mass spectrometry is used for the detection.

Finally, because of their high water solubility, acrolein and acrylonitrile are determined by direct aqueous injection on Chromosorb 101 with mass spectrometric detection. However, more recent work has shown that these compounds can also be measured by the purge and trap technique.[4]

Identification is based on the appearance of mass chromatograms (extracted ion current profiles) for three characteristic ions for each compounds. As an example, for the three dichlorobenzene isomers, the molecular ions at 146 and 148 and the fragment ion at 113 are used for identification and quantification. The ions must appear at the correct retention time with the correct relative responses in order to be considered a positive identification. Quantitation is based on external standard methods for the volatile organics and pesticide fractions and internal standard methods for the base/neutral and acid fractions. The internal standard for these fractions is fully deuterated anthracene which has a molecular ion occurring at mass 188.

The metals are analyzed by flameless atomic absorption (AA) and cyanide and total phenols are colorimetrically determined.[5] Cyanide is measured colorimetrically by converting to cyanogen chloride with chloramine-T which reacts with pyridine to give a product that forms a colored complex with barbituric acid. Total phenol is colorimetrically determined by oxidizing with potassium ferricyanide to give quinones that condense with 4-aminoantipyrine to form colored complexes.

Quality Assurance Requirements

The original priority pollutant methodology document[2] specified several quality assurance (QA) requirements, but additional features were subsequently added[6,7]. These requirements include the following:

1. Method Blank

The method blank is defined as an appropriate volume of "organic-free" water which has been processed exactly as a sample (same glassware, reagents, solvents, etc.). For the extractable parameters (B/N, A, P) this would require extraction of one liter of water. For the volatile fraction, 5ml of "organic-free" water should be analyzed by the purge and trap methodology. One method blank sample should be run with every batch of 20 or fewer samples. Also, a method blank should be run whenever a new source of reagent or solvent is introduced into the analytical scheme. Reagents having background levels that interfer with the compounds to be determined must be purified and shown to be acceptable or replaced with some that are acceptable.

2. Field Blank

It is the responsibility of the sampling team to provide the appropriate field blanks to the analytical team. For the extractable parameters (B/N, A, P) the minimum requirement is to provide an appropriate volume of blank water which has been processed through the sampling equipment in the same manner as a sample. The field blank is then analyzed in the laboratory as if it were a sample. When inteferences occur, the analytical results must be discarded or flagged so as not to result in the reporting of false positives. Field blanks for the volatiles consists of "organic-free" water which has been sent from the laboratory to the sampling site and retained with the samples. The purpose is to check on possible contamination of the sample by permeation of volatiles through the septum seal. Sample blanks should be protected with activated carbon during transit and during storage in the laboratory.

3. Replicates

To determine the precision of the method, a regular program of analyses of replicate aliquots of environmental samples must be carried out. At least two replicate aliquots of a well mixed samples must be analyzed with each set of 20 samples or less analyzed at a given time. For those parameters where a sufficient number of positive results are accumulated over a period of time, precision criteria should be developed. A minimum of 15 replicates at a particular concentration or concentration range where linearity exists is required to start an on-going program for QA and subsequent estimates of precision.

4. Standard Additions to Samples

These are additions of known amounts of authentic standard to the sample. The samples are then processed and analyzed in the same manner as a sample. The percent recovery is then determined as described in reference 6. At least one spiked sample is analyzed along with each set of 20 samples or less. Spiked data are obtained for each parameter of interest.

5. Standard Addition to Blank Water (Method Standard)

These are additions of known amounts of authentic standards to the water blank before extraction. The samples are then processed and analyzed in the same manner as a sample. The standard should be approximately equal to the concentration found in routine samples. The percent recovery is determined as described in reference 6. At least one method standard must be analyzed along with each set of 20 samples or less.

6. Surrogate Spikes

These are standards which are added to every sample prior to analysis. The standards chosen should be chemically similar to compounds in the fraction being analyzed. Also, the standards should be compounds which would not likely be found in environmental samples. The purpose of the surrogate spike is to provide quality control on every sample by constantly monitoring for unusual matrix effects, gross sample processing error, etc. The surrogate spike should not be used as an internal standard for quantitation purposes.

7. GC/MS Calibration Check

For the base/neutral fraction, and acid fraction decafluorotriphenylphosphine (DFTPP) is run daily according to EPA procedures. The requirement is for 50 nanograms of DFTPP to meet relative ion abundance criteria[8]. For the volatile fraction pentaflurobromobenzene (PFBB) is run daily according to EPA procedures. The requirement is for 100 nanograms of PFBB to meet the relative ion abundance criteria[7]. More recently, p-fluorobromobenzene has been recommended as a replacement for PFBB.[9]

8. GC Performance Check

For the base/neutral fraction, benzidine is run daily either separately or as a part of a standard mixture. The requirement is to be able to chromatograph the compound at the 100 nanogram level. For the acid fraction, pentachlorophenol is analyzed daily either separately or as part of a standard mixture. The requirement is to be able to chromatograph the compound at the 100 nanogram level while giving an acceptable tailing factor[7,10]. For the pesticide fraction, Aldrin is run daily either separately or as part of a standard mixture. An injection of 100 picograms should give a recorder response of at least 50% full-scale deflection.

Results and Discussion

The results have been condensed and summarized in eight tables. In order to maintain readability, information such as the number of data points contributed by each lab for each parameter and the corresponding concentration range have not been included. Also specific results from each laboratory for each parameter are not included. These data are, however, available from the authors upon request.

Interlaboratory Comparison

All the data in this report was collected before June 1979, while the controlling protocol was published in April 1977. There are four primary laboratories (cf. with acknowledgment) contributing almost 10,000 data points to this review. Some of the data was statistically rejected. In Laboratory I, 3% of the B/N and metal analytical data was rejected using the statistical one-sided test at the 2.5% significance level[11]. Similary, 0.3% of the data from Laboratory II was also excluded. A total of 18% of the data from Laboratory III was rejected for two reasons: 1) the spiking levels were not at least two times above the background level (especially at low levels) and 2) application of the one-sided test suggested to a 97.5% confidence that the data removed were likely outliers.

The data are expressed in terms of percent recovery (P) plus or minus (±) one standard deviation (Sp) where

$$Sp = \sqrt{\frac{\sum_{i=1}^{n} P_i^2 - (\sum_{i=1}^{n} P_i)^2/n}{n-1}}$$

Table I summarizes the data for the various classes of priority pollutants. The interlaboratory comparison gives the average recovery of only the compounds analyzed by all the contributing laboratories in the method standard analysis. Once this comparison set had been determined, then the same set of compounds was used as the basis for interlaboratory comparison for the matrix spike. This precaution minimized data variability between the laboratories due to properties associated with the individual compounds like volatility, reactivity, etc. (vide infra). Laboratory III had no method standard analytical data and had analyzed fewer compounds. Note that Sp in the interlaboratory comparison is the deviation of the recovery means and not measurement deviation.

PURGEABLE ORGANIC COMPOUNDS. As part of the process of quality assurance Labs I, II, III, and IV analyzed field blanks consisting of organic-free water that was transported to the analytical laboratory along with the samples. Invariably, dichloromethane (methylene chloride), the extraction solvent, was observed in field blanks and laboratory blanks. Typical levels for laboratory IV were 2 ± 1 parts per billion. No data are reported for 2-chloroethyl vinyl ether and bis(chloromethyl) ether; the former appears not to have been available and the latter is an alpha-chloromethyl ether which is well known to undergo facile hydrolysis. In a ten month stability study, Radian Corporation found that the initial concentration of both these ethers in their methanolic standard was reduced to zero probably from substitution reactions with methanol[12]. Also, the concentration of acrolein was reduced to zero. Note that acrolein can undergo air oxidation, Michael addition, and dimethyl acetal formation in methanol.

Tables I and II summarize the results obtained for the purgeables. The difference in recoveries between the method standard analysis and matrix spiked analysis should be indicative of sample matrix effects and in this case there appears to be slight increase in recovery in going from the method standard analysis (Interlab Comparison Average = 90 ± 13) to the matrix spiked analysis (Interlab Comparison Average = 92 ± 15).

Volatility is a very important variable in the analysis of the purgeable organic compounds (VOA). Labs I and III have omitted analysis of many of the most volatile compounds, including bromomethane, chlormethane, dichlorodifluoromethane, and vinyl chloride. Inspection of the individual laboratory data show significant differences in going from the most volatile group of compounds (bp < 75°C) to the least volatile compounds (bp > 112°C) for Labs I and III only. Recoveries increase and relative standard deviations decrease. Using the two-tailed statistical test for significance of the sample differences between the most volatile group and the intermediate and least volatile groups, assuming there is no difference between the population means from which these samples are drawn [13], it is established to a greater than 99.9% confidence that the observed difference for these groups arise from volatility. Lab II cooled their Tenax sorbent trap with liquid CO_2 and Lab IV used a sorbent trap mix containing Tenax, silica gel, and activated charcoal. In a separate precision study (method standard analysis) by Lab IV involving five measurements at each of four different concentration, standard deviations of 11.2±3.4 and 10.0±2.4 were obtained for the most volatile group (11 compounds or 220 data points) and the intermediate and least volatile groups (17 compounds or 340 data points), respectively. Thus, to a 95% confidence it appears that even in analytical laboratories where volatility is mainly under control, the more volatile compounds exhibit greater measurement fluctuation.

Comparison of the recovery data of deuterated purgeable organic surrogates in Table VII versus the recoveries of the corresponding nondeuterated priority pollutant in Table II gives, respectively, 93±22 and 93±24 for benzene, 139±96 and 110±21 for chloroform, 146±55 and 88±24 for dichloromethane, 94±18 and 106±28 for ethylbenzene, 92±18 from 97±25 for toluene, 119±29 and 103±27 for 1,2-dichloroethane, and 117±41 and 94±36 for 1,1,1-trichloroethane. The large scatter for the data would suggest that d-chloroform and d_2-dichloromethane are poor choices for surrogates.

PHENOLIC ACIDS

After the B/N compounds have been extracted from the alkaline sample with methylene chloride (Figure 1), the aqueous phase is made acidic with 6N HCl and again extracted with methylene chloride. This latter methylene chloride extract is dried by passing through a column of anhydrous sodium sulfate and the solvent concentrated by distillation in Kuderna-Danish apparatus. Lab III investigated acid carryover in waste samples from the leather tanning industry which tended to form emulsions and therefore were extracted continously for 24 hours; they noted a pH change from greater than 11 to 8-9. In a separate study, Lab IV demonstrated that, in the absence of emulsions, significiant carryover of only the weakest acids, 2-4-dimethylphenol (50%) and 4-chloro-3-methylphenol (10%), occurred. Lab V minimized emulsion problems by dilution of the creosote waste from the wood preserving industry before commencing to analyze it.

A strong relationship exits between acid volatility and analytical recovery. In all laboratories contributing to this report, acid recovery was lower for the more volatile phenols (bp < 211°C: 2-chlorphenol, phenol, 2,4-dichlorophenol, and 2,4-dimethylphenol), than for the less volatile ones (bp >211°C: 2-nitrophenol, 4-chloro-3-methylphenol, 2,4,6-trichlorophenol, and pentachlorphenol). In general, the relative standard deviation decreased in going from the most volatile to least volatile group; the p-nitrophenols were excluded from consideration in the volatility grouping because of their propensity to thermally undergo intramolecular oxidation to p-quinones which may also explain why these phenols chromatograph poorly. Application of the two-tailed statistical test for significance of the overall difference in recoveries for these two groups of acids results in a greater than 95% confidence that the volatility hypothesis is valid.

Comparison of the recoveries of phenol (Table III, 54±24) and d_5-phenol (Table VII, 55±20) suggests that d_5-phenol is a good choice for a surrogate.

BASE/NEUTRALS COMPOUNDS

The simultaneous analysis of the 46 B/N compounds probably represents the most difficult task in the analysis of the organic priority pollutants. This report summarizes the analytical results of 43 B/N compounds. No analytical results for bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, or N-nitrosodimethylamine are contained in this report. Presumably, 4-chlorophenyl phenyl ether and bis(2-chloroethoxy)methane are not readily acquired. Absence of data for N-nitrosodimethylamine probably results because of its poor chromatc graphic properties (GC gives a low broad peak). Also it is questionable whether bis (2-chloroethoxy)methane is stable enough in the aqueous environment, particularly under basic conditions, to be analyzable per the specified methodology. Dibutyl and bis(2-ethylhexyl) phthalates were invariably present in the method and field blanks analyzed by Labs III and IV. Since the waste samples from the leather tanning and timber industries were particularly beset with emulsion problems, some carryover of B/N compounds into the acid fraction was observed. The most significant carryover occurred in the lagoon influent samples taken from the timber industry, and these samples invariably had a high background of the prioirty pollutant being analyzed. Analysis for the basic compounds in the acid fraction would probably be futile since they form hydrochloride salts that would most likely remain in the aqueous phase even if they were carried into the acid fraction. If the B/N compounds are separated into reactive and nonreactive groups, then discernible recovery differences become evident (Table VIII). The reactive group comprises of the alkyl amines and chlorides, the phthalate esters, and isophorone (an enone); the nonreactive group consists of all the other B/N compounds. It is well known that alkyl amines and chlorides react with each other to produce alkylated ammonium salts[14]. Futhermore, alkyl chlorides can undergo elimination and substitution reactions, like reaction with hydroxide ion to form alkene and alcohols (aryl chlorides are inert to mucleophilic substituion and are placed in the nonreactive group); perchlorocarbons can also form aldehydes, ketones, and carboxylic acids by reaction with hydroxide ion. Esters are saponified by base and isophorone can undergo condensation and Michael addition reaction[14]. Thus, greater analytical variability is to be expected in the B/N reactive group. The data in Table VIII appears to verify this anticipation since, in general, recovery decreases and relative standard deviation increases in going from the nonreactive group to the reactive group. Lab II and Lab IV have noted instability indications associated with the standards for the B/N analysis. Radian Corporation did a ten month storage stability study of their B/N standard in methylene chloride and found significant changes in the concentrations of the chloroalkyl ethers, N-nitrosoamines, hexachlorocyclopentadiene, dibenzo(a,h)anthracene, and benzidine[12]. Because of emulsion problems, Lab III used continuous extractors in the analytical processing of the samples from the leather tanning and timber industries. As noted earlier the pH was initially adjusted to above 11, but after 24 hours of extraction the pH dropped to 8-9. Lab III performed analyses on sample matrices from a more complex and diverse industrial cross section and have the lowest Interlab Comparison recovery value (55±24) in Table I, in spite of statistical refinement of the data. Other problems in the GC/MS screening of the B/N compounds include coelution of anthracene with phenanthrene, benzo(a)anthracene with chrysene, and benzo(b)fluoranthrene with benzo(k)fluoranthrene coupled with the inability to distinguish between these pairs by mass spectrometry. Thermal decomposition of 1,2-diphenylhydrazine to azobenzene and N-nitrosodiphenylamine to diphenyl amine and tetraphenylhydrazine has been documented[15].

Comparison of the respective recoveries for d_8-naphthalene (76±22) and d_5-nitrobenzene (70±71) in Table VII versus naphthalene (89±51) and nitrobenzene (77±51) in Table IV is favorable.

PESTICIDES

The GC/EC analysis of the pesticides is the most straight-forward of the organic priority pollutants[3]. Since found Chlordane, PCB, and Toxaphene are indistinguishable due to interferences between the many compounds in the spike, that the pesticides are spiked in groups of compounds known to be separable. Endrin aldehyde has a high standard deviation in Table V probably because of partial air oxidation to a carboxylic acid.

METALS

For the most part, none of the laboratories had difficulty in the metals analysis above concentration of approximately 25 ppb. The high standard deviations present in the data of Lab I is no doubt due to the low spiking level which is close to the detection limit of the method used by the laboratory. In the flameless analysis of zinc, environmental contamination problems were apparently experienced by Labs I and II. It is also possible that in the method standard analysis of chromium, copper, and nickel, Lab I was having contamination problems from copper and stainless steel plumbing.

CYANIDE AND TOTAL PHENOLS

Total phenols were colorimetrically determined by Labs II and IV via a totally automated procedure[5]. Recovery data for the cyanide and total phenols are presented in Table VI.

SUMMARY AND CONCLUSIONS

A summary of the overall recoveries of the priority pollutants is given in Table I. In every case, except for the purgeable organic compounds, the overall recovery decreases and the relative standard deviation increases in going from the method standard to the matrix spiked analysis. Of the organic priority pollutants, the analysis of the purgeable and acid organic compounds results in the highest recoveries with the smallest matrix effect. The increase in recovery of the purgeable organic compounds and the decrease in recovery for the phenolic acids in going from unadulterated water to a matrix aqueous medium may be a salting-out and salting-in effect, respectively, and needs to be studied. The two major variables for these groups is volatility and carryover of phenolic acids into the B/N fraction, the latter arising mainly from emulsion problems since the data from Lab III suggest that no pka dependence was associated with their observed acid carryover. The process of continuous extraction itself may be responsible for carry over which needs to be experimentally determined. Volatility can be controlled by close monitoring of the analytical process. Ascertaining that the pH is greater than 11 and, in the case of emulsion, performing an additional base wash of the B/N methylene chloride extract will rectify carryover of the acids into the B/N fraction. The question concerning the stability of methylene chloride during long term (24 hour) contact with hydroxide solution under emulsion conditions needs to be investigated.

In part, the analysis of the base/neutral and pesticide compounds give the lowest recoveries because of their greater propensity to react among each other or with hydroxide or water[14]. Several laboratories have noted that when the four different B/N methanolic standards are mixed in methylene chloride that this solution becomes turbid and eventually changes to a yellow color. Thus, the stability of the priority pollutants, benzidine and 1,2-diphenylhydrazine in contact with methylene chloride needs to be fully determined. Saponification of the phthalate esters has been observed during the B/N analysis by several laboratories. Another major variable in the analysis of the B/N compounds is carryover into the acid fraction in the presence of emulsions; this appears to be particularly acute at high background concentrations of the B/N component.

The VOA analysis per the EPA protocol has proved to be the most successful. The acid and pesticide analyses have been moderately successful, and the B/N analysis has been less successful on samples with severe matrix problems, as from the leather tanning and timber industries. Nevertheless, the present methodology is adequate and appears capable of improvement. We can be confident that false positive analyses are considerably less likely than false negative analyses so that when a priority pollutant is detected in the environment we know the measured quantity is probably smaller than the true value. Table IX summarizes problems associated with the current priority pollutant methodology.

Initial recommended performance control limits can be computed by adding (upper control limits, UCL) or subtracting (lower control limit LCL) three times the standard deviation from the average percent recovery values presented in Tables I to VIII[16]. Some of LCL's will no doubt increase as the analytical methodology improves. Also, one should note that these control limits are somewhat dependent upon the level of standard addition, the degree of which has not been fully investigated.

Acknowledgement

The major portion of the data in this summary came from EPA-Region VII and EPA Quality Assurance Contract Reports from A.D. Little. Inc. Acorn Park, Cambridge, MA 02140 (EPA contract #68-01-3857) Carborundum Co. 3401 LaGrande Blvd. Sacramento CA 95823 (EPA contract #68-01-4689) and Versar, INC., 6621 Electronics Dr., Springfield, VA 22151 (EPA contract # 68-01-3852).

Literature Cited

1. Environmental Science and Technology, February 1978, p. 154

2. "Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants," US EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, March 1976 (Revised April 1977)

3. Federal Register, 38(125), 17318(1973)

4. "Midwest Research Institute Final Letter Report on Evaluation of Test Procedure for Acrolein and Acrylonitrile, "MRI Project NO. 4719-A, US EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, June, 1979.

5. "Methods for Chemical Analysis of Water and Wastes," US EPA, Enviromental Monitoring and Support Laboratory, Cincinnati, OH 45268, March, 1979.

6. "Procedure for Preliminary Evaluation of Analytical Methods to be Used in the Verification Phase of the Effluent Guidelines Division BAT Review," US EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, March 1978.

7. "Addendum for Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants," US EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, April, 1979.

8. J.W. Eichelberger, L.E. Harris, and W.L. Budde, Anal. Chem.,47, 995 (1975)

9. Federal Register, Volume 44, NO. 233, December 3, 1979. "Guidelines Establishing Test Procedures for the Analysis of Pollutants, Proposed Regulations".

10. H.M. McNair and E.J. Bonelli, "Basic Gas Chromatography," Consolidated Printing, Berkeley, CA, 1969, p.52.

11. American Society of Testing and Materials., D2777.

12. Private communications with Dr. L.H. Keith, Radian Corporation., Austin, Texas.

13. M.R. Spiegel, "Statistics," (Schaum's Outline Series), McGraw-Hill Book Co., San Francison, CA, 1961, p. 170.

14. R. Morrison and R. Boyd, "Organic Chemistry," 2nd Edition, Allyn and Bacon Inc., Boston, MA, 1969

15. "Seminar on Analytical Methods For Priority Pollutants," Proceedings, US EPA, Denver, Colorado, November, 1977.

16. "Handbook for Analytical Control in Water and Wastewater Laboratories," US EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, March, 1979.

TABLE I. INTERLABORATORY COMPARISON[a]

Priority Pollutant Fraction[b]	LAB I	LAB II	LAB III	LAB IV	LAB V	LAB VII	Average[c]
Volatile (MS)	88±21	95±5	-	100±8	-	-	90±13
Volatile Sample Spike	82±24	101±9	93±13	107±9	-	-	92±15
Acid (MS)	90±18	89±5	-	67±14	82±16	-	84±13
Acid Sample Blank	92±34	72±10	62±12	60±15	84±17	-	76±19
B/N-(MS)	95±25	78±41	-	77±15	-	-	84±25
B/N Sample Spike	84±18	61±22	55±24	68±16	-	63±13	68±21
Pesticide (MS)	73±8	74±19	-	88±8	-	-	78±11
Pesticide Sample Spike	69±7	51±18	33±10	93±5	-	-	59±11
Metals (MS)	113±37	-	-	103±8	-	-	108±22
Metals Sample Spike	100±20	103±14		92±7	-	-	96±11
Cyanide (MS)	103±14	-	-	103±8	-	-	103±7
Cyanide Sample Spike	101±12	-	-	93±16	-	-	96±14
Phenolics (MS)	10±13	97±6	-	100±7	-	-	101±8
Phenolics Sample Spike	93±15	98±10	-	97±9	-	-	96±11

a) The values are in units of percent recovery (P) plus or minus (±) one standard deviations (Sp).
b) MS refers to the method standard or the standard addition to blank water. Sample spike refers to the standard addition to a sample.
c) P and Sp are weighted averages based on the number of data points contributed by each laboratory.

TABLE II. Purgeable Organics[a]

Compound	Method[b] Standard	Standard[c] Spike
Acrolein	77±30	32±30
Acrylonitrile	96±31	102±28
Benzene	89±12	93±24
Bromodichloromethane	97±11	103±31
Bromoform	94±14	88±12
Bromomethane	90±16	78±15
Carbon Tetrachloride	91±23	91±33
Chlorobenzene	94±23	103±24
Chlorodibromomethane	86±12	99±17
Chloroethane	67±22	60±23
Chloroform	90±18	91±26
Chloromethane	91±22	64±28
Dichlorodifluoromethane	108±11*	114±8*
1,1-Dichloroethane	83±10	87±21
1,2-Dichloroethane	102±12	103±27
1,1-Dichloroethylene	74±24	80±32
trans-1,2-Dichloroethylene	90±25	85±35
Dichloromethane	82±46	66±66
1,2-Dichloropropane	94±26	99±30
cis-1,3-Dichloropropene	95±15	98±20
trans -1-3-Dichloropropene	91±13	93±16
Ethylbenzene	109±19	106±28

Continuation of Table II

Compound	Method Standard	Sample Spike
1,1,2,2-Tetrachloroethane	81±31	78±31
Tetrachloroethylene	97±13	99±26
Toluene	96±22	97±25
1,1,1-Trichloroethane	92±21	94±36
1,1,2-Trichloroethane	102±14	103±19
Trichloroethylene	106±14	110±22
Trichlorofluoromethane	59±23	67±48
Vinyl Chloride	103±30	79±22

a) The values are in terms of P ± Sp. Data from 2-4 laboratories have been averaged except where noted with an (*) asterisk. In general the concentration added ranged from 10 to 1000 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.

*Data from only one lab were available.

TABLE III. ACID FRACTION[a]

COMPOUND	METHOD[b] STANDARD	SAMPLE[c] SPIKE
2-Chlorophenol	80±22	71±23
4-Chloro-3-methylphenol	96±16	99±19
2,4-Dichlorophenol	86±24	84±23
2,4-Dimethylphenol	71±19	72±16
4,6-Dinitro-*o*-cresol	87±34	102±23
2,4-Dinitrophenol	89±22	92±40
2-Nitrophenol	95±22	87±22
4-Nitrophenol	65±33	59±46
Pentachlorophenol	87±24	84±22
Phenol	61±11	54±24
2,4,6-Trichlorophneol	91±22	80±24

a) The values are in terms of P ± Sp. Data from 2-5 laboratories have been averaged. In general the concentration added ranged from 20 to 2500 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.

TABLE IV BASE/NEUTRAL FRACTION[A]

Compound	Method[b] Standard	Sample[c] Spike
Acenaphthene	90±22	78±24
Acenapthylene	83±22	79±27
Anthracene[d]	98±20	79±26
Benzidine	44±27	40±29
Benzo(a)anthracene[e]	105±33	51±24
Benzo(b)fluoranthene[f]	96±68*	41±21
Benzo(k)fluoranthene[f]	96±68	47±27
Benzo(a)pyrene	90±22	43±21
Benzyl Butyl Phthalate	49±39	49±22
Bis(2-chloroethyl) Ether	98±48	80±49
Bis(2-chloroisopropyl) Ether	154±136	96±88
Bis(2-ethylhexyl) Phthalate	70±33	66±50
4-Bromophenyl Phenyl Ether	80±25	63±25
2-Chloronaphthalene	88±20	79±21
Chrysene[e]	105±33	77±27
Dibenzo(a,h)anthracene	80±42	36±29
Di-n-butyl Phthalate	80±32	58±27
1,2-Dichlorobenzene	65±24	65±27
1,3-Dichlorobenzene	67±21	62±20
1,4-Dichlorobenzene	67±22	63±21
3,3'-Dichlorobenzidine	71±85	62±45

Compound	Method[b] Standard	Sample[c] Spike
Diethyl Phthalate	71±37	65±37
Dimethyl Phthalate	43±37	66±43
2,4-Dinitrotoluene	122±55	94±45
2,6-Dinitrotoluene	115±41	104±35
Di-n-octyl Phthalate	84±44	88±32
1,2-Diphenylhydrazine (and/or Azobenzene)	97±26	91±32
Fluoranthene	111±26	63±20
Fluorene	98±24	88±25
Hexachlorobenzene	98±31	76±31
Hexachlorobutadiene	76±26	77±45
Hexachlorocyclopentadiene	38±28	27±10
Hexachloroethane	63±22	58±23
Isophorone	66±36	67±22
Indeno(1,2,3-cd)pyrene	109±14	40±21
Naphthalene	83±24	89±51
Nitrobenzene	106±31	77±51
N-nitrosodipheylamine (and/or Diphenylamine)	72±22	66±25
N-Nitrosodi-*n*-propylamine	86±34	71±22
Phenanthrene	98±20	79±20
Pyrene	142±41	63±20
1,2,4-Trichlorobenzene	74±22	69±24

a) The values are in terms of P ± Sp. Data from 2-5 laboratories have been averaged except where noted with an (*) asterisk. In general the concentration added ranged from 10 to 500 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
d,e,f) These isomers pairs are not separted by packed column GC. Also mass spectral data are not sufficiently unique to allow differentiation.
*Data from only one lab were available.

TABLE V. PESTICIDE FRACTION[a]

Compound	Method[b] Standard	Sample[c] Spike
Aldrin	72±13	55±12
alpha-BHC	78±13	55±12
beta-BHC	79±21	57±22
gamma-BHC	78±14	64±11
delta-BHC	82±16	61±16
Chlordane	81±17*	39±9*
4,4'-DDD	82±14	62±16
4,4'-DDE	76±14	57±18
4,4'-DDT	85±17	76±26
Dieldrin	71±14	62±16
Endosulfan I	65±14	61±13
Endosulfan II	67±19	66±14
Endosulfane Sulfate	74±39*	84±30*
Endrin	82±25	68±18
Endrin Aldehyde	64±76*	34±39*
Heptachlor	72±12	49±12
Heptachlor Epoxide	82±14	65±11
PCB	83±11*	42±13
Toxaphene	89±12*	-

a) The values are in terms of P ± Sp. Data from 2-4 laboratories have been averaged except where noted with an (*)asterisk. In general the concentration added ranged from 0.1 to 100 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
*Data from only one lab were available.

TABLE VI. METALS, CYANDIE, AND PHENOLICS[a]

PARAMETER	METHOD[b] STANDARD	SAMPLE[c] SPIKE
Antimony	61±47*	103±24
Arsenic	120±20	97±25
Beryllium	89±16	94±20
Cadmium	91±18	98±23
Chromium	99±30	106±25
Copper	136±70	99±24
Lead	116±32	93±25
Mercury[d]	83±24	79±38
Nickel	84±62	101±26
Selenium	112±15	93±20
Silver	110±25	80±25
Thallium	99±33*	95±23
Zinc	122±44	106±37
Cyanide	103±7	96±14
Total Phenols	101±8	96±11

a) The values are in terms of P ± Sp. Data from 2-3 laboratories have been averaged exept where noted with an (*) asterisk. In genral the concentration added ranged from 10 to 1000 parts per billion.
b) Standard addition to blank water.
c) Standard addition to sample.
d) Analyzed by the cold vapor technique.

*Data from only one lab were available.

TABLE VII. PRIORITY POLLUTANT SURROGATES[A]

Compound	LAB III[b]	LAB IV[c]	LAB VIII[d]
(Purgeable Orgnaics)			
d_6-Benzene	-	95±10	-
Bromochloromethane	-	98±11	-
d-Chloroform	139±96	-	-
1,4-Dichlorobutane	-	96±10	-
d_4-1,2-Dichloroethane	119±29	-	-
d_2-Dichloromethane	146±55	-	-
d_{10}-Ethylbenzene	102±25	97±12	-
Fluorobenzene	96±20	-	-
d_8-Toluene	-	95±10	-
d_3-1,1,1-Trichloroethane	117±41	-	-
1-chloro-2-bromopropane		93±11	
(Acids)			
2-Fluorophenol	76±36	-	-
Pentafluorophenol	84±30	50±22	101±39
d_5-Phenol	55±20	-	-
Trifluoro-m-cresol	72±42	-	-
(Base/Neutral)			
Decafluorobiphenyl	39±18	41±29	46±13
d_8-Napthalene	76±22	-	-
2-fluoronaphthalene	75±20	-	-
1-fluoronaphthalene	69±18	-	-
d_{12}-benzo(a)anthracene	68±16	-	-
2-fluorobiphenyl	63±5	-	-

Table VII (cont'd)

d_5-aniline	57±36	-	-

Compound	LAB III[b]	LAB IV[c]	LAB VIII[d]
2-fluoroaniline	74±39	-	-
d_5-nitrobenzene	70±21	-	-

a) The values are in terms of P ± Sp. The concentration added ranged from 20 to 200 parts per billion.
b) The matrix for these surrogates included influent and effluent samples from 12 different industrial categories.
c) The matrix for these surrogates included POTW, detergent, and chemical disposal industries.
d) The matrix for these surrogates included POTW samples only.

TABLE VIII. REACTIVITY GROUPS OF THE B/N PRIORITY POLLUTANTS

	Method Standard Analysis		Matrix Spiked Analysis	
	Nonreactive Group	Reactive Group	Nonreactive Group	Reactive Group
Laboratory	P+Sp	P+Sp	P+Sp	P+Sp
I	102±26	86±21	87±18	78±17
II	93±31	52±46	60±21	64±25
III	-	-	58±26	48±12
IV	82±10	67±18	71±12	63±18
VII	-	-	65±11	57±17

Nonreactive B/N Compounds: Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(g,h,i)perylene, benzo(a)pyrene, 2-Chloronaphthalene, 1,2-,1,3-, and 1,4-Dichlorobenzene, 2,6-Dinitrotoluene, Fluoranthene, Fluorene, Hexachlorobenzene, Napthalene, Nitrobenzene, Pyrene, and 1,2,4-Trichlorobenzene.

Reactive B/N Compounds: Benzidine, Bis(2-chloroethyl) Ether, Bis(2-ethylhexyl), Diethyl, and Dimethyl Phthalates, 1,2-Diphenylhydrazine, Hexachlorobutadiene, Hexachloroethane, and Isophorone.

TABLE IX PROBLEM PRIORITY POLLUTANTS

COMPOUND	PROBLEM
Dichloromethane	Frequently found in blanks and samples because of in lab contamination.
bis-chloromethylether	Readily hydrolyzed in water.
N-nitrosodimethylamine	Poor chromatographic properties.
Di-n-butylphthalate	Frequently found in blanks.
Bis-(2-ethylhexyl)phthalate	Frequently found in blanks.
1,2-diphenylhydrazine	Thermally decomposes to diphenyl amine and tetraphenylhydrazine.
Benzidine	Poor chromatographic properties.
Hexachlorocyclopentadiene	Subject to thermal and hydrolytic decomposition.
Endrin Aldehyde	Is readily oxidized.
Anthracene and Phenanthrene	Coelute on packed columns.
Chrysene and benzo(a)-Anthracene	Coelute on packed columns.
benzo(b)fluoranthrene and benzo(k)fluoranthrene	Coelute on packed columns.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

[illegible]

OFFICE OF
RESEARCH AND DEVELOPMENT

SUBJECT: Toxics Data System—Evaluation of Region VII Data Set

FROM: Chris Timm, Director
Quality Assurance Management Staff
Office of Monitoring and Technical Support (RD-680)

TO: Edmund Notzon, Director
Monitoring and Data Support Division
Office of Water and Waste Management (WH-553)

In response to the request by Fred Leutner at the May Agency Quality Assurance Advisory Committee meeting, the QAMS agreed to review your evaluation of the four data sets prepared for the initiation of the Toxics Substances Data Systems. Subsequently, I met with Paul Durand of your staff to review the files on your original assessment. As I understand it, the initial assessment was developed solely by phone coversations between your staff and the project officers or principal investigators with no further documentation of the compliance with data evaluation criteria.

Consequently, I requested Bob Booth, Deputy Director, Environmental Monitoring Systems Laboratory-Cincinnati, to evaluate the Region VII data set in order to verify their reported status for each of the criteria being considered. Bob completed his evaluation during the week of June 23-26, 1980, and a copy of his report is attached.

Based upon this report, we believe that the Region VII data set is of adequate quality and documentation for input into the Toxics Substances Data System. We do recommend, though, that some type of assessment of the data quality, such as the Quality Assurance Criteria recommended earlier or preferably, a numerical assessment of precision and accuracy be input along with the data in order to assure future credibility.

We are proceeding with a review of the other three data sets, based upon the information provided by your staff, and should have our evaluation reports to you before September 30, 1980.

Attachment

cc: Courtney Riordan (RD-680)
Richard Dowd (A-101)
Robert Booth (EMSL-CI)
Thomas Stanley (RD-680)
Sidney Verner (RD-680)
[illegible] (RD-680)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY
CINCINNATI, OHIO 45268

DATE: July 24, 1980

SUBJECT: Toxics Data System; Evaluation of Region 7 Data

FROM: Robert L. Booth, Deputy Director R. L. Booth
Environmental Monitoring and Support
Laboratory - Cincinnati

TO: Christopher M. Timm, Director
Quality Assurance Management Staff 7/30
Office of Monitoring and Technical Support

Per our discussions on this subject, I reviewed the Region 7 data sets that are being considered as part of the pilot storage study for TOXET. The following comments are made around the headings of the "check list reference" table given in Ned Notzon's draft of April 23, 1980. This evaluation was made as part of our on-site evaluation of Region 7's laboratory during the week of June 23-26, 1980.

1. STATION IDENTIFICATION

The data to be considered for the pilot study will be that generated from the POTW studies being done for O'Farrel's group in headquarters. The stations were apparently picked by O'Farrel. Burns and Row, the prime contractor, is responsible for the sampling. In my discussion with Charles Hensley and Billy Fairless, it was recognized that there is probably not an adequate station identification/description for STORET/TOXET purposes at this time. Providing resources were made available to the region, this information can be provided.

2. IN STORET FORMAT

The identification number is assigned by the prime contractor and the sample is shipped to the regional laboratory. Once the analysis has been completed and the results reviewed by Charles Hensley the data are forwarded to O'Farrell. Regional staff do not believe the data are currently in EPA STORET format. Again, the region does have the necsessary expertise to provide this required input but additional resources would need to be provided.

3. QUALITY ASSURANCE (QA) PLAN APPROVED

No formal plan was prepared for the study. In reviewing their QA program I learned that the following protocol is being used.

a. In a set of 12-16 samples representing a single POTW site, the region is provided with a field blank and at least one duplicate sample by the contractor.

b. A spiked sample is prepared in the laboratory.

c. Once a set of approximately 15 duplicate and spiked data points is available, i.e., from 15 different POTW sources, a statistical summary is prepared.

d. Two standard deviations is used as a warning limit and three standard deviations as a control limit. These limits are generated by the lab staff on the above mentioned samples. Their precision and accuracy data are significantly better than the data being provided by the other three contractors in the POTW studies. In fact, as a side issue, in my review of the data, I would strongly recommend that at least 2 of the 3 contractors be fired and that their data be purged from the system.

The regional QA plan is now available in draft form. As you know, however, it does not provide the kind of detail that is needed for a laboratory QA plan. This will probably be forthcoming when the laboratory staff is required to prepare standard operating procedures and QA project plans as a part of the Agency's Mandatory QA Program.

4. QA AUDITS

The laboratory has actively participated in our performance evaluation studies, and they routinely make use of our Quality Control check samples. A review of their data shows that they are within the Agency's acceptance limits 98% of the time for all contaminants at varied concentration levels. Clearly, they rank as one of the Agency's best laboratories in this category.

5. QUALITY CONTROL (QC)

It was apparent from our on-site lab evaluation and from the candid conversations that I had with management, that region 7 has an excellent on-going QC program. As is the case with a number of programs, there is a need to document in some areas what is being done. Overall, the field collection, laboratory analysis, and data management systems are being quality-controlled in an exemplary manner.

6. PRECISION AND ACCURACY

As indicated, precision and accurancy data are available on real world samples. More importantly, they have a strong data base from previous studies to compare their current performance samples. Their methods of calibration are well documented and they are readily available. In this regard, it should be noted that Dr. Jerry Dias, a consultant to their program, has done an outstanding job in presenting their QA data in an easy to follow manner. Perhaps even more noteworthy, he has had an opportunity to review the data and make some interesting observations concerning the fate of these organic contaminants in the environment.

7. METHODS

Approved methods are being used in the POTW studies. The organic analysis is being done by use of GC/MS techniques and the toxic metals are being done by ICP . Both methods are published in the Federal Register and will be part of final rulemaking for section 304(h) methodology in the near future.

8. DATA REVIEW

The following system is used for review of data:

a. Data are provided to a key puncher with an absolute minimum number of transfers by staff.

b. Key puncher provides data cards which are verified by a second party.

c. Roy Crossland, Data Coordinator for the region, does a spot review of the data printout and makes certain checks to verify validation of data.

d. Charles Hensley, Acting Chief, also reviews the printout in a similar manner before approving its forwarding to headquarters. Although a detailed line-by-line review of the data is not being made, any major errors are probably being caught by this review process.

As we have discussed, a very important element that is not covered in the table heading is that of sample conditions. This would include the type of containers used, the preservative used, and the holding times that are required. In reviewing these elements with the laboratory staff, it would appear that there is a holding time problem for the organics. This is limited to the holding time that the sample extraction may be held after the liquid liquid extraction has been made on the aqueous sample. In some cases, due to instrumental failure or an unusually large number of samples coming in at one time, sample extractions are being held for longer than the currently recognized holding times. They are already running two shifts to alleviate this problem and have taken other actions to limit the instances in which sample extracts are held too long.

All of the above information was provided to Paul Durand in a meeting held in Alexandria, Virginia, on July 17. At his request, I provided him this detailed information so that he would be properly perpared for a briefing he was to have with Ned Notzon on July 25. As I noted to him, I believe that, overall, the POTW data being generated by Region 7 can be used in this pilot study. It is obvious, however, that certain elements need to be strengthened before we can consciously say "yes" on the check list table.

cc: Charles Hensley, Chief, Laboratory Branch, Surveillance and Analysis Division, U.S. EPA, Region 7
Billy Fairless, Deputy Director, Surveillance and Analysis Division, U.S. EPA, Region 7